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CUTANEOUS MEDICINE

LOUIS A. DUHRING

PART I.

CUTANEOUS MEDICINE

A SYSTEMATIC TREATISE
ON THE
DISEASES OF THE SKIN

BY

LOUIS A. DUHRING, M.D.

PROFESSOR OF DISEASES OF THE SKIN IN THE UNIVERSITY OF PENNSYLVANIA;
AUTHOR OF "A PRACTICAL TREATISE ON DISEASES OF THE SKIN"
AND "ATLAS OF SKIN DISEASES."

PART I.

Anatomy of the Skin—Physiology of the Skin—General Symptomatology—General Etiology—General Pathology—General Diagnosis—General Treatment—General Prognosis.

ILLUSTRATED

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TO THE MEMBERS

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WHO BY THEIR FAITHFUL SERVICE AND VALUABLE
CONTRIBUTIONS TO THIS

DEPARTMENT OF MEDICINE

HAVE GAINED THE UNIVERSAL RESPECT AND HONOR OF THE
PROFESSION

THIS WORK

IS

Dedicated

WITH SENTIMENTS OF HIGHEST ESTEEM AND REGARD

BY

THE AUTHOR

PREFACE.

THE present work has been written to take the place of the author's former Practical Treatise on Diseases of the Skin, which for several years has been out of print. The favorable reception accorded to that work by the medical profession everywhere as attested by the many thousand copies published, by the press in this country and abroad, and by its translation into French, Italian, and Russian, has led the author to believe that a larger and more comprehensive treatise on the same subject might be equally well received.

The material dealt with in the present volume has on all sides been approached from a practical stand-point. It has been the aim of the author to adhere closely to the practical aspect of the subject, supported by science and by experience. The work, as a whole, rests on clinical observation supported by pathology and pathological anatomy. The principles of cutaneous pathology and therapeutics have been put forth upon conservative lines in the light of modern research and experience. The rapid strides that Dermatology has taken during the past decade have produced remarkable changes in the pathology of many of the diseases of the skin, but clinical observations are on this account none the less valuable and important.

The author is convinced that the skin occupies a more conspicuous place in Medicine than has heretofore been accorded to it. It is a large, complex, important organ of the body, and is by no means a mere protective covering. It is not only subject to many diseases which are wholly confined to the skin, but is also intimately connected with numerous general morbid processes, to describe and to point out the significance of which is within the province of Cutaneous Medicine. It occupies a very broad and useful field of observation. No other organ of the body offers such inducements to the pathologist for study. When the skin is carefully investigated, and when the signs with which it is marked by disease are properly interpreted, in many instances most valuable general information is yielded to the clinician as well as to the pathologist.

The view is taken by the author that the skin and subcutaneous tissue, composing the integument, should be regarded as a part of the body rather than as an independent organ. The skin possesses the closest relations with the general economy, as shown by the observation that there are comparatively few so-called general diseases in which it (including naturally the sweat and sebaceous glandular systems) is not at some period involved in a slight or a marked degree. It may be in the form merely of general anæmia or hyperæmia, but either condition may be significant of some general pathological process. Hence there is a great deal to be learned from the close study of this organ in various diseases other than those in which obvious erythematous, inflamed, atrophic or hypertrophic lesions (constituting many of the so-called skin-diseases) exist. In the study of diseases in which this organ is affected, taking for example the erythemata as a group, it is often impossible to determine where the line may be drawn separating the idiopathic from the symptomatic cutaneous diseases,—those which might properly be designated pure "skin-diseases" from those in which other organs as well as the skin are involved. The author is convinced that in many instances such lines cannot be drawn. In these cases, if attempt be made to adhere strictly to such an arbitrary decision, confusion must result. For these reasons the systematic study of cutaneous diseases must embrace not only all the affections involving the skin, as exemplified by strictly local diseases, but also all morbid processes in which the integument is in any manner or degree affected. Dermatology is thus broadened, and its usefulness to General Medicine becomes obvious.

An accurate knowledge of the anatomy and physiology of the skin aids greatly the understanding of the diseases which affect this organ. In like manner a comprehensive view of the general etiology and pathology of the integument assists the student in comprehending the meaning of the numerous and diverse manifestations which occur on the skin. For these reasons considerable attention has been bestowed on these topics, which may be regarded as the foundation-stones of Dermatology.

The opinions expressed on therapeutics are in the main the result of the author's convictions, based upon an extensive clinical experience with cutaneous diseases at home and abroad, in hospital, dispensary, and private practice, extending over a period of nearly thirty years. The matter has been written in the plainest language, with the view that it should prove useful to the student as well as to the physician.

The authors and writers of the United States and of foreign countries, especially of Great Britain, Germany, and France, have been drawn upon freely, and it has been the endeavor of the author to give credit for all original investigations. No one appreciates more fully than he the admirable work that has been done for Dermatology in all parts of the world. The United States, especially through the medium of the American Dermatological Association, has contributed a liberal share. The subject of the skin and all that pertains to it, in health as well as in disease, has received a great impetus in the way of original investigation and general interest, not only through the medium of bacteriology, but also in many other directions. Cutaneous Medicine is rapidly assuming the elevated position to which it is entitled. It is a natural, and therefore a legitimate, specialty of General Medicine, and covers a very extensive, almost limitless, field for the investigator.

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PART I.

GENERAL CONSIDERATIONS.

ANATOMY OF THE SKIN.

THE SKIN AS A WHOLE.

A careful study of the skin as a whole, and of its component parts, is a matter of the greatest importance to the proper understanding of its manifold diseases. Without a comprehension of the minute anatomy of this complex membrane it is impossible to appreciate the pathological processes and the changes resulting therefrom which constitute the diseases of the skin. The diagnosis of these affections depends to a considerable extent upon close acquaintance with the anatomy of this organ. The skin is not merely the covering of the organism, but is also the seat of functional action, in the form of absorption and secretion, and in the elimination of various products of the economy. It is also a regulator of the bodily temperature, and an organ of touch. The skin is a highly vascular and sentient organ, being endowed with special nerve apparatus, by means of which knowledge of the objects coming in contact with it is obtained. It will be noted, therefore, that an understanding of its physiology is likewise important. Some of the diseases, as, for example, those of secretion, are mainly or entirely abnormal physiological processes. The skin has many offices to perform. It is not only the outer covering of the body, subject to external influences of all kinds, but it also has relations with various tissues leading to other organs. To estimate justly the part it plays in the healthy economy and in disease, therefore, both the anatomy and the physiology must be studied.

GENERAL CHARACTERISTICS.

The skin, or integumentum commune, is a covering which completely invests the body. It is a flexible, tough membrane, possessing extensibility and elasticity. It offers considerable resistance to external agencies of all kinds, and thus serves as a protecting organ. This function is due largely to the subcutaneous adipose tissue, which fills up the spaces and depressions caused by the several organs and appendages of the integument. Forces acting from within towards the surface, too, are regulated by the skin, which acts as a barrier. To the touch the general surface has a soft, smooth, more or less unctuous feel, especially upon those regions devoid of coarse hairs and usually kept covered. In certain localities, however, and particularly in exposed parts, it is dry, or may even be harsh, as over joints and on the extremities.

Upon the surface there are numerous lines and markings of various size and form, which are well defined upon the face, hands, and feet, and larger and deeper furrows occur about the joints and elsewhere. Numerous minute depressions, so-called PORES, the orifices of glandular ducts and of hair-follicles, also exist over the surface. Hairs, coarse and fine, occur upon almost all regions, more abundantly in some localities than in others, and serve useful purposes. The color of the skin varies with the race and with the locality. The thickness is likewise variable, depending on the region, being thickest on the back, buttocks, palms, and soles, and thinnest on the eyelids and prepuce. J. Gastreich,[1] who has studied the subject of the transparency of the human skin by the method of sections, finds the epidermis more translucent than the corium, and by staining shows the walls of the veins to be more so than those of the arteries.

The integument viewed anatomically is a complex organization. It consists of parts, some of which are essential and are everywhere present, while others are special and exist only in certain regions. To the first group belong the epidermis, corium, and subcutaneous connective tissue; to the second, the sebaceous and sweat glands, hairs, nails, and special terminal nerve organs, all designated APPENDAGES OF THE SKIN. In addition to the constituents mentioned, the skin contains blood-vessels, lymphatics, and medullated and non-medullated nerve fibres.

EARLY DEVELOPMENT OF THE SKIN.

First, the early development of the skin is to be considered, whereby the order and manner of its formation during intra-uterine life may be noted. According to the teachings of embryology, two layers only of the skin are recognized, the epidermis and the corium. The corium is the foundation of the skin, and is developed from the superficial layer of the mesoblast, designated by Remak the SKIN-PLATE. The minute histology of the skin of the embryo has been investigated by Unna,[2] to whose observations reference will be made, and more recently by Louis Heitzmann,[3] who has studied a series of sections derived from embryos of all ages, from one to nine months. According to this author, at the end of the first month the whole product consists of indifferent medullary or embryonal elements. The surface of the skin shows one or two layers of epithelium with large nuclei, the corium consisting of shining, structureless, homogeneous masses surrounded with a protoplasmic net-work composed of light granular bodies bound together with delicate threads. Between the second and the third month the indifferent masses undergo a change into oblong and spindle-form bodies embedded in the protoplasm extensions which have assumed a spindle form. The nucleus-like formations near the surface are closely pressed together, and separated from one another by scanty protoplasm, while in the deeper layers they are less numerous and are separated by heavier layers of streaked or elongated protoplasm, the reticular form of the latter still existing.

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[1] Monatshefte für prak. Derm., Bd. xii. S. 495.

[2] Anatomy and development of the skin, in Ziemssen's "Hand-Book of Skin Diseases" (translation). New York, 1885. The author takes this opportunity of acknowledging the assistance he has derived from this valuable article.

[3] This observer holds to, and has elaborated, the views concerning protoplasm and basis-substance put forth by Schwann, in 1839, Max Schultze, in 1862, and Carl Heitzmann, in 1873. The last-named author observed that the basis-substance of all varieties of connective tissue was not inert but living material. This, as concerned hyalin cartilage, was confirmed by A. Spina in 1879. Louis Heitzmann has recently found this to be true for the skin. The view is expressed that the basis-substance *in toto* is not living, but that this substance is permeated by a net-work of living matter. Basis-substance and protoplasm are regarded as of the same structure; either may at

PROTOPLASM BECOMES BASIS-SUBSTANCE.

The protoplasm under a high power is noted to have changed into small, spindle-shaped forms having a close connection with the oblong nuclei. Here and there are encountered elongated nucleated bodies in connection with simple, double, or divided prolongations,—the "caudate fibro-plastic cells" of authors, as described originally by Schwann. These cells L. Heitzmann regards as being artificial productions caused by tearing the preparation, for they are not constant. In the deeper strata of the future corium delicate bundles of so-called fibrillar connective tissue are at this period met with. It appears plain that all the fibrillæ are built up from spindles, which differ from the protoplasmic spindles only in being more shining. Now for the first time the transformation of protoplasm into basis-substance becomes manifest. Inasmuch as in this process the reticular structure of the original protoplasm remains intact, the deduction may be drawn that only the matter in the reticular spaces which contain fluid undergoes a chemical transformation into collagenous substance. At this stage of the development are observed masses of strongly refractive granules of variable sizes and number seated in the protoplasm. These are the blood-cells of Schwann and the hæmatoblasts of C. Heitzmann, from which result the blood-vessels and the red blood-corpuscles. An inner layer is now conspicuous, which shows a deposition of fat and forms the subcutaneous tissue. This latter has been called the "hypoderm" by Besnier, and really belongs to the corium.

STRUCTURE OF THE EARLY CORIUM.

The entire corium matures from within outwards, and hence the subcutaneous tissue is the first layer and the papillary layer of the corium

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any time pass into the other. Protoplasm advances physiologically into basis-substance, and the latter, on the other hand, in senile atrophy, and especially in pathological processes, passes into protoplasm. "Die Entwicklunggeschichte der Lederhaut," in Archiv für Derm. u. Syph., 1890, p. 621,—an article to which the author expresses his indebtedness.

the last to develop. Between the third and the fourth month the layers of the epithelium become more numerous, the lower strata sinking into the corium as button-form prolongations to form future glands, hairs, and hair-follicles. The whole corium at this stage is made up of myxofibrous structure. In the fifth month the corium again changes, the myxomatous tissue disappearing and being replaced by a more collagenous basis-substance, which henceforth increases steadily. Between the seventh and the eighth month the bundles of tissue of the corium become more marked, and numerous hæmatoblasts appear. Heitzmann's observations go to show that the red blood-corpuscles occur primarily in the connective tissue without previous formation of vessels and independently of them. At this date fine reticular fibrillæ, myxomatous in nature, characterized by refracting light strongly, make their appearance, which eventually may become elastic fibres. During fœtal life the subcutaneous tissue develops more than any other portion of the integument, owing to the deposit in it of fat tissue. After birth the fat tends to decrease, except at certain points of the body, the subcutaneous tissue becoming a loose net-work.

ARRANGEMENT OF CELLS AND FASCICULI.

As the corium continues to mature, its component cells and bundles take on a definite plan of arrangement, varying for different regions and localities. As Unna explains this, the skin, as the outer covering of the entire body, is forced to follow it in its increased bulk, and is therefore kept in a state of permanent tension, thus exerting an influence upon the long axes of the cells. The trunk and extremities at this stage of life being short cylindrical bodies, the circular growth of the skin exceeds that in a longitudinal direction in the proportion of about three to two. The long axes of the spindle cells naturally yield to the stronger traction, and consequently arrange themselves at right angles to the long axes of the trunk and extremities. This course of the cells, having been established in the fœtus, becomes more marked after birth by the further development of fibrous tissue. In consequence of the extension of the flexed extremities after birth, and the increased growth in length which then begins to take place, the direction of many of the connective-tissue cells and bundles becomes changed from a transverse into a curved, spiral, or longitudinal course, such changes occurring chiefly near the joints, as C. Langer[1] has shown.

PAPILLARY LAYER.

The papillary layer manifests itself about the fourth month upon the palms and soles (Unna), produced by the epidermis projecting itself into the corium, giving rise to groove-like depressions. From this date onward the epidermis and papillary layer are closely connected, the one dovetailing into the other. But the formation and development of this layer vary with the region, it appearing earlier in some localities and later in others. Thus, Heitzmann states that it first shows itself upon the neck, in the form of flat elevations, during the eighth month. Its formation at an early or a late period depends upon the amount of epithelial proliferation, and hence it is developed earliest where the epidermis is naturally thickest.

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[1] Zur Anat. u. Phys. der Haut (I. Die Spaltbarkeit der Cutis ; II. Die Spannung der Cutis), Sitzungsb. der Wiener k. Akad. der Wissensch., math.-naturwiss. Classe, xliv. Bd. I. Abth., Jahrg. 1861, Wien, 1862, und xlv. Bd. I. Abth., Jahrg. 1862, Wien, 1862. The articles are important contributions, the first being finely illustrated by C. Heitzmann.

THE EPIDERMIS A DISTINCT LAYER.

The epidermis is a distinct layer, having no relation genetically with the papillary layer. It springs from its own matrix, the ectoderm. In the first month a single layer of cells is present, and in the second month a second row between the first row and the corium makes its appearance, the outer or original stratum becoming flatter, resembling in shape the subsequent horny layer. From the third to the fifth month from two to four rows exist, the cells now showing prickles on their borders, due to the presence of fine connecting threads between the cells. The horny layer remains thin, and, according to Unna, at the seventh month has only two rows of cells, the outermost, non-nucleated cells being mixed with fat and transformed into the vernix caseosa. Granular cells show themselves between the prickle-cells and the horny cells, and more complete cornification sets in. The mucous layer is exceedingly active from the fifth to the eighth month, during which period the hairs and glands are being formed from this structure by cell division. With the cornification of the horny layer a barrier to the outward proliferation of the prickle-cells is established, proliferation in consequence tending to take place inwardly, thus pressing upon the soft and yielding corium and forming the papillæ.

Having thus considered the general development of the skin before birth, the anatomy and histology of the mature structure may now be described.[1]

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[1] Acknowledgment is here made to the "Atlas of Histology," by Klein and Smith, Phila., 1879; to "Microscopical Morphology of the Animal Body in Health and Disease," New York, 1883, by C. Heitzmann; and to A. Biesiadecki's article "Skin," in Stricker's Hand-Book of Human and Comparative Histology. London, 1872. Also to essays by C. Remy on the "Histology of the Normal Skin of Man," Gaz. Méd. de Paris, May 4, 1878; abstract in Archives of Derm., 1879, p. 57; by J. Renaut, "Anatomy of the Skin," in Annales de Derm. et de Syph., 1878; and by Louis Heitzmann on the "Anatomy of the Skin," in Morrow's System of Dermatology. New York, 1894. Special mention remains to be made of the sterling work "Handbuch der Gewebelehre des Menschen" (sechste umgearbeitete Auflage, Band i., Leipzig, 1889) by A. Koelliker, from which on many points the author has derived aid. A full bibliography up to 1885 of the anatomy of the skin may be found in Dict. Encyclop. des Sci. Méd., art. PEAU. Paris, 1886.

CORIUM.

The corium, called also DERMA, CUTIS, CUTIS VERA, and TRUE SKIN, is the most important part of the integument. It is a dense and tough structure, made up mainly of white fibrous tissue. Elastic fibres are also present, varying in quantity with the locality. It is exceedingly vascular and sentient, and, besides blood-vessels, nerves, and terminal nerve organs, contains lymphatics, smooth muscles, hairs, sebaceous and sweat glands, and fat-cells, which are situated in the interfascicular spaces. The corium is divided into two portions, an upper and a lower, termed respectively the PAPILLARY LAYER and the RETICULAR LAYER. These strata are not separated by any line, but pass gradually into each other. The upper portion, or papillary layer, is raised into prominences termed PAPILLÆ, to be referred to elsewhere, while the lower portion passes without a line of demarcation into the subcutaneous connective tissue. The corium, therefore, is not a plane surface, but consists of numerous elevations and depressions, and of folds and duplicatures, which are obliterated by traction or by tension of the deeper structures. Linear markings, wrinkles, and furrows of variable size also occur, further reference to which will be made elsewhere. Above the corium rests the non-vascular epidermis, with its epithelial cells fitting closely upon and dovetailed into the papillary layer.

STRUCTURE OF THE CORIUM.

The framework of the corium is composed largely of white fibrous connective tissue with a variable amount of elastic tissue, containing but few cells. The former is present, as shown in excised sections of skin, in the form of small and large stout bundles, or trabeculæ, assuming an undulating, wavy course; but, as Unna has pointed out, it is probable that during life the fibres are in a constant state of tension. The trabeculæ interlace and cross one another in various directions, forming a net-work. This is denser and firmer in the upper and looser in the lower strata of the corium. The so-called connective-tissue corpuscles are nucleated flattened cells, possessing flat, branched, filamentous processes, which enter the finer bundles of fibres. They exist in greatest number in the vicinity of the larger vessels. Louis Heitzmann[1] regards the so-called "connective-tissue corpuscles" as unaltered protoplasm, and the "fibrillæ" as protoplasm infiltrated with basis-substance.

The bundles of connective tissue assume a certain regularity of arrangement, crossing and recrossing for the most part obliquely, as demonstrated by Dupuytren and Malgaigne, but especially by C. Langer.[2] This constitutes the CLEAVAGE OF THE SKIN. Upon puncturing the skin with an awl and withdrawing the instrument, instead of round holes longitudinal clefts are observed. In certain localities, however, where the derma is closely attached to the subcutaneous tissues, there is a felting or matting together of the bundles, when the openings produced by the instrument are irregular or jagged.

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[1] Der feinere Bau der normalen Lederhaut, Archiv für Derm. u. Syph., 1890.

[2] Loc. cit. This subject had previously been studied by Dupuytren in connection with wounds made by arms in war (Ueber die Verletzungen durch Kriegswaffen. Aus der Franz., 1836, p. 27. Quoted by C. Langer). Malgaigne also made similar observations, Traité d'Anatomie chirurgicale, t. i. p 76, 1859.

The existence of a cement-substance in the corium, described by Flemming[1] as an ill-defined, cloudy mass enveloping the bundles of fibres, may be referred to. Its presence does not seem to be proved, though its existence has been asserted by good observers. Tomsa is of opinion that it holds the fibrous and other elements of the skin together, and is the factor of the elasticity in the fresh skin, while Langer believes that the positive retraction of the skin which often occurs is caused by it.

The boundary between the corium and the epidermis is marked by a pale, thin, membranous structure, with oval nuclei, the so-called BASEMENT OR BASAL MEMBRANE, conspicuous in stained preparations. According to E. Klein's[2] observations, it is made up of the basis of the individual cells which has undergone a chemical and morphological change, and hence is a product of the deepest layers of the epithelium. Unna, on the other hand, is opposed to this structure being regarded as a basal membrane, viewing it rather in the light of a cement-substance than of a membrane. Balzer and Unna[3] are both of opinion that extremely fine elastic fibres sometimes penetrate this so-called basal membrane, pushing themselves between the cylindrical cells of the mucous layer.

ELASTIC FIBRES.

At what period of life elastic fibres ("yellow elastic tissue") first make their appearance does not seem to be established. Some authors state that they are not observed in the embryo nor in the new-born. According to the recent studies of Passarge and Kroesing,[4] however, this tissue in the skin begins to develop between the seventh and the eighth month of fœtal life from the intercellular substance, in the form of granules arranged in rows and ultimately becoming fibres, or, as it seems, connective-tissue fibres may be infiltrated and become elastic fibres. The elastic fibres and net-work of the papillæ, as well as those of the reticular and subpapillary layers, are formed later.

Elastic fibres vary in number in different individuals, and according to L. Heitzmann's[5] investigations they occur more sparsely in women than in men. As F. Balzer,[6] however, has pointed out in his extended study of these fibres, they are more abundant in general than was formerly supposed to be the case. They occur in almost all parts of the corium, especially in the upper strata, though W. Tomsa[1] and L. Heitzmann state that they are altogether wanting or sparse in the papillæ. They run parallel with the connective-tissue bundles, and are connected by lateral branches into a net-work. The fibres are variable in size, and are fine or coarse, according to the localities where they occur. In the lower strata they form an open reticulum. Concerning their intimate nature, L. Heitzmann expresses the view that they do not constitute a tissue *sui generis*, but that they are rather fibrillar connective tissue, infiltrated with an exceedingly firm and persistent basis-substance, the "elastin" of the chemists. Both A. Spina[2] and L. Heitzmann agree that they arise from protoplasm.

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[1] Quoted from Unna, loc. cit., p. 5.

[2] Atlas of Histology. Phila., 1879.

[3] Monatshefte f. prak. Derm., 1883.

[4] Schwund und Regeneration des elastischen Gewebes der Haut unter verschieden pathologischen Verhältnissen. Hamburg, 1894.

[5] Archiv für Derm. u. Syph., 1890.

[6] Recherches techniques sur le tissu élastique de la Peau.—Rapports du tissu musculaire et du tissu élastique, Archives de Physiol., Oct. 1882, p. 314. See also a lengthy critical review by Unna in Monatsh. für prak. Derm., 1883.

The relation of the elastic fibres to the extensibility of the skin is differently interpreted. Tomsa's experiments show that they play an insignificant part in this function, while Unna considers that the retractile power of this tissue can only be understood by recognizing its relations to the involuntary muscles of the skin. When separated from other structures of the skin they show little retractile power. According to Ravogli,[3] they increase with advancing years, and with this increase there is a corresponding decrease of the white fibrous connective-tissue cells.

The elastic tissue of the skin in middle-aged and elderly persons has been carefully studied by E. Sederholm.[4] This observer confirms the researches of Schmidt,[5] and especially the following points. The elastic net-work of the excretory duct of the sudoriparous glands becomes transformed into an elastic membrane, which may serve to explain, perhaps, the diminution in old persons of the secretion of the sweat glands. The smooth muscles attached to the fibrous portion of the hair-follicle become inserted into the elastic net-work of the skin after the atrophy of the hair. The amount of the elastic substance becomes increased in the interior and around the smooth muscles. The elastic sheath of the corpuscle of Meissner becomes more bulky and more solid. Around the central mass of the Pacinian body an elastic net-work formed of anastomosing circular fibres is met with, the first traces of which appear between the ages of forty and fifty.

PAPILLARY LAYER AND PAPILLÆ.

In the papillary layer of the corium, known also as PARS PAPILLARIS CORII, which derives its name from the peculiar formation of its upper

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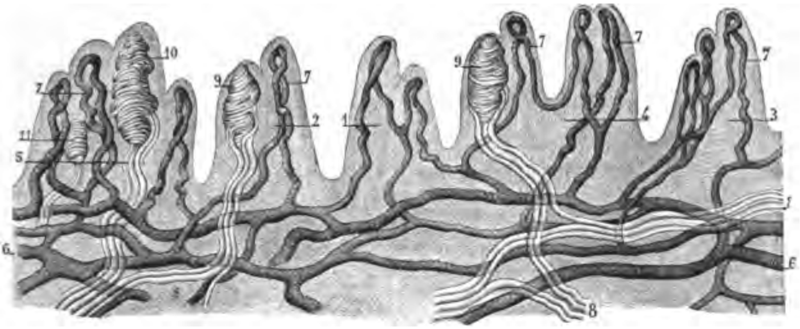
[1] Beiträge zur Anat. u. Phys. der menschlichen Haut, Archiv für Derm. u. Syph., 1873, S. 1.

[2] Untersuchungen über die Veränderungen der Zellen in entzündeten Sehnen, Med. Jahrbüch., 1877.

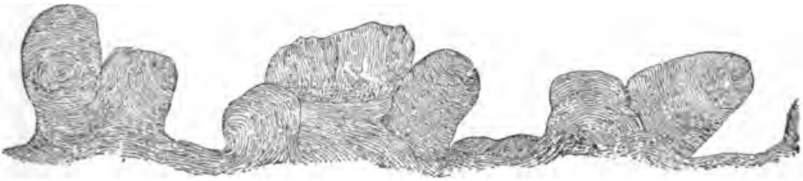
[3] Med. Jahrbücher, Heft 1, 1879.

[4] Nordiskt Medicinskt Arkiv, Bd. ii. Heft 3, 1892.

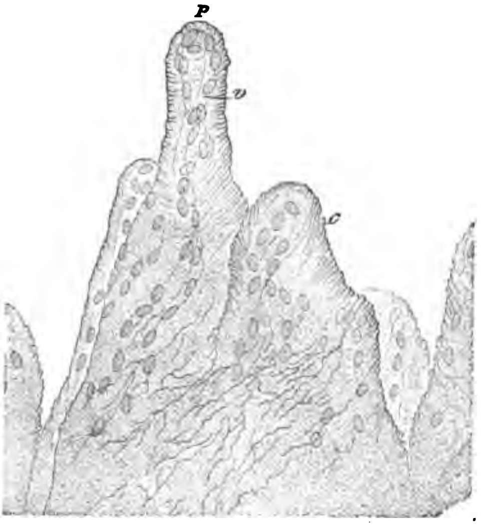
[5] Virchow's Archiv, Bd. cxxv., 1891.



Papillæ of the Palm of the Hand.—Vessels of these Papillæ; Tactile Corpuscles in some of the Papillæ, and Nerves which supply them. —1, bifid papilla, containing two vascular loops; 2, another bifid papilla, presenting a vascular loop and a tactile corpuscle; 3, trifid papilla, showing three vascular loops; 4, large papilla divided into two secondary papillæ, which are subdivided at their summit; one of these secondary papillæ receives two vascular loops, the other contains a loop and a corpuscle; 5, composite papilla, in which are noted three vascular loops and two corpuscles; 6, 6, net-work of blood-vessels from which go off the capillaries that supply the papillæ; 7, 7, 7, 7, vascular loops of these papillæ; 8, 8, 8, nerves which contribute to form the subpapillary plexus; 9, 9, two tactile corpuscles of average size, receiving each three nerve-fibres; 10, a larger corpuscle, supplied with four fibres; 11, small corpuscle, which receives only two fibres. (Sappey.)



Surface of the Corium deprived of the Epidermis, showing papillæ in varied shapes. (Unna.)



Section of Skin of the Pulp of a Finger, after Maceration in Iodized Serum. The epidermis is removed.—*p*, papilla; *v*, blood-vessel; *c*, ridges on papilla. (Ranvier.)

surface, the bundles of connective tissue are fine, and beneath the papillæ run horizontally, or parallel with the surface of the integument. The net-work is close, the bundles being small and felted together, forming a dense structure. The PAPILLÆ consist of variously sized and shaped, nipple like or teat-like prolongations or prominences on the surface of the corium. They are seated upon ridges, low or high, of the corium. They are blunt-conical or club-shaped, and are either single or are joined together by a common base, in which case they receive the name of "compound papillæ." They vary not only in size and shape, but also in number, according to the region. The largest and most perfectly formed are found on the palm of the hand, on the inner surfaces of the fingers and toes, especially on the terminal phalanges, and on the sole of the foot. Upon these regions they have the form of nipple-shaped bodies with circular bases. They are upon an average from one and a half to two times higher than they are broad, and vary in height from 0.05 to 0.02 mm. They are also well defined on the scalp, while upon the face they are shorter, broader, and flatter. They are placed very closely together on the labia minora, clitoris, penis, and nipple. Upon the scrotum, neck, breast, abdomen, and back, and on the extensor surfaces of the limbs, they occur sparsely. Where the skin is thin, as on the flexor surfaces, they are less developed, and in some regions they exist merely in the form of slight elevations or flattened prominences, or may be altogether wanting.

They are arranged in the form of irregular, more or less curved rows. Upon the palms, soles, fingers, and toes they are placed side by side in striæ, two or more rows of them being included within two of the external lines visible to the naked eye. As O. Simon[1] has shown, their systematic linear arrangement depends upon the direction of the connective-tissue bundles of the corium. Upon the ends of the fingers they are particularly numerous, and here Meissner[2] counted 400 elevations to one square line (2.116 mm.) of surface, and E. H. Weber, upon the same space on the palm of the hand, counted 81 compound papillæ, or from 150 to 200 smaller papillæ. Sappey[3] estimates that there are about 100 papillæ to the square millimetre, which would give for the whole surface of the body about 150,000,000, on the basis of 15,000 square centimetres to the whole superficial area of the skin.

Papillæ are divided into two kinds, according to their internal structure, termed VASCULAR and SENSORY. The former are well supplied with blood-vessels, while the latter are made up in great part of connective tissue containing medullated nerves, and possess but a limited amount of vascularity.

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[1] Die Localisation der Hautkrankheiten histologisch und klinisch bearbeitet. Mit 5 Tafeln. Berlin, 1873.

[2] Beiträge zur Anat. u. Phys. der Haut. Leipzig, 1853.

[3] Traité d'Anatomie Descriptive, t. iii. Paris, 1877.

The intimate structure of the papillæ is much the same as that of the corium, the bundles, however, being finer and arranged parallel with the long axis of the papilla. Elastic fibres are scanty or entirely wanting. Where the prickle layer cells come in contact with the papillary layer a more or less well-defined stratum, the so-called basement or basal membrane, exists, to which reference has already been made.

RELATION OF PAPILLÆ TO EPIDERMIS.

The papillary layer and the epidermis viewed together play an important part in both physiology and pathology, and are the seat of manifold and diverse diseases. The surface of the corium readily adapts itself to the impression made upon it by the proliferating epidermis, and the formation of the papillary layer, as to the size and shape of papillæ, is largely under the influence of these epithelial cells. From this statement it will be noted that the papillary layer is by no means a fixed, rigid formation. It is, on the contrary, a yielding structure, its form depending upon the activity of the epithelial proliferation, and also upon the forces acting upon the skin from within. H. Auspitz[1] was the first observer to direct attention to this point, and especially to its importance as a factor in disease. The papillary layer may, as Unna suggests, be regarded in the light of a cushion and as a filter of nutriment for the epidermis.

ARRANGEMENT OF PAPILLÆ.

The fibrous layers of the corium are arranged in definite directions, as has been shown by C. Langer and Oscar Simon, the ARRANGEMENT OF THE PAPILLÆ being determined by the longitudinal trend of the connective-tissue bundles; and, furthermore, the latter govern the arrangement of the natural furrows of the skin. The disposition of the vessels and nerves, and even of the glands, is also in part regulated by the same general controlling influence of the trend of the connective tissue. The distribution of the papillæ exhibits a system, with a well-defined linear arrangement, which is different for the several regions and localities of the cutaneous surface. There is, therefore, no irregularity in the distribution of the linear markings, furrows, and folds of the surface: all follow definite tracks. This will be the more readily understood when it is remembered that the papillary layer does not begin to form until the connective tissue is well matured in the later months of intra-uterine life.

The relations of the epidermis to the papillary layer are important in connection with the superficial lines upon the surface of the skin, the subject having been investigated particularly by Blaschko,[2] as well as by Phillipson.

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[1] Ueber das Verhältniss der Oberhaut zur Papillarschicht, Archiv für Derm. u. Syph., 1870, p. 81.

[2] Beiträge zur Anat. der Oberhaut, Archiv für Mikr. Anat., Bd. xxx.

A definite scheme of architecture exists for the normal skin, by which to a certain extent some of the pathological changes that have their seat in this organ are regulated. This is noted in the general distribution and in the arrangement or grouping of individual primary lesions, and also in a more pronounced manner in the healing of wounds and the mechanism of scars. The latter problem has been worked out carefully by G. J. Swerchesky.[1]

RETICULAR LAYER.

The papillary layer merges into the reticular layer, or PARS RETICULARIS, without line of demarcation, the difference between these strata consisting in the arrangement of the connective-tissue bundles. The reticular portion is looser in texture, being made up of fasciculi of connective tissue which decussate more or less obliquely and give it a plexiform arrangement. As the bundles ascend towards the surface they divide into smaller and finer bundles until the papillary layer is reached, where a close felt-like arrangement of the fibres exists.

THICKNESS OF THE CORIUM.

The thickness of the corium varies greatly, depending on the region and locality. In the infant it is thin, the subcutaneous tissue being relatively very thick. In the adult it is thickest upon the soles, palms, buttocks, and entire back, and thinnest upon the eyelids, prepuce, glans penis, and inner surface of the labia majora. It is thin also upon the face, ears, scrotum, perineum, and areola of the nipple. Koelliker[2] estimates it at from $\frac{1}{8}'''$ (.2645 mm.) to $1\frac{1}{2}'''$ (3.174 mm.), in most localities averaging about $\frac{1}{4}'''$ (.5290 mm.). Landois[3] makes it thicker,—from 2.7 mm. to 3.3 mm. Koelliker's[4] more recent calculations place the figures at 0.3 to 2.4 mm., with an average of 0.56 to 1.70. It is remarkably thick in the negro. Constant exposure to wind and weather, as Krause originally pointed out, has a tendency to thicken the skin. The development of the epidermis, and especially of the horny layer, as on the palms and the soles, has much to do with the thickness of the cutaneous covering.

SUPERFICIAL ARCHITECTURE OF THE SKIN.

Under this heading is to be considered the general superficies of the skin as concerns its numerous elevations and depressions, including the folds, furrows, lines, and wrinkles, together with the arrangement of the elements composing the corium, especially the papillary layer.

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[1] Contribution to the Physiology and Pathology of Scars, Amer. Jour. of Syph. and Derm., July, 1871, and July, 1872. Illustrated.

[2] Manual of Human Microscopic Anatomy. London, 1860, p. 76.

[3] Human Physiology, vol. ii. p. 657. 2d English ed., London, 1886.

[4] Handbuch der Gewebelehre des Menschen, sechste Auflage. Leipzig, 1889, Bd. i. p. 161.

The upper surface of the skin, including its covering, the epidermis, is everywhere marked with lines, furrows, and folds. Some of these are fine and others coarse, the whole constituting a systematic linear arrangement, which may be designated as the SUPERFICIAL ARCHITECTURE OF THE SKIN. The direction of these lines and furrows, their form, division, and symmetry, are well defined and constant for certain regions, as has been shown by the studies of Bichat,[1] and more recently especially by C. Langer,[2] and also by O. Simon and Lewinski.

The several forms may be described under the headings of (1) regular furrows, as those of the palms and soles and the flexor surfaces of the fingers and toes; and (2) curved and irregular furrows, which occur over the whole general surface. The deeper of these assume a spindle form or diamond shape, and sometimes a three-cornered or a quadrilateral form. The natural lines of the surface extend down as far as the mucous layer, and are due to a sinking-in of the horny layer, the linear area being devoid of papillary prominences.

CLEAVAGE OF THE SKIN.

C. Langer was the first to study carefully the so-called CLEAVAGE OF THE SKIN, or the direction of the connective-tissue bundles for certain regions. Allusion has already been made to this subject in considering the structure of the corium, where it is shown that experiments prove the existence of a definite arrangement of the fibres and bundles of the connective tissue of the corium. The great extensibility of the integument is largely due to this distribution of the fibres. As Langer stated, the extensibility as well as the retractive power of the skin does not lie in the physical peculiarities of its elements, but rather in the net-like arrangement of its tissues. If the skin is stretched, the tissues arrange themselves in the direction of the traction, and when this ceases the net returns to its original arrangement.

FURROWS AND FOLDS.

The subject of the FURROWS and FOLDS of the skin has been carefully studied by Lewinski[3] and also by Phillipson.[4] As Lewinski states, all the visible lines on the surface are due to the formation of folds, caused by the motion of the part. The number of the folds hence depends on the number of motions of which the body is capable. The younger the individual the more elastic is the skin; the lines, therefore, are lighter and the folds flatter, and the surface is more easily smoothed by change of position. The formation of the marked folds which occur in elderly persons is by this explanation made clear.

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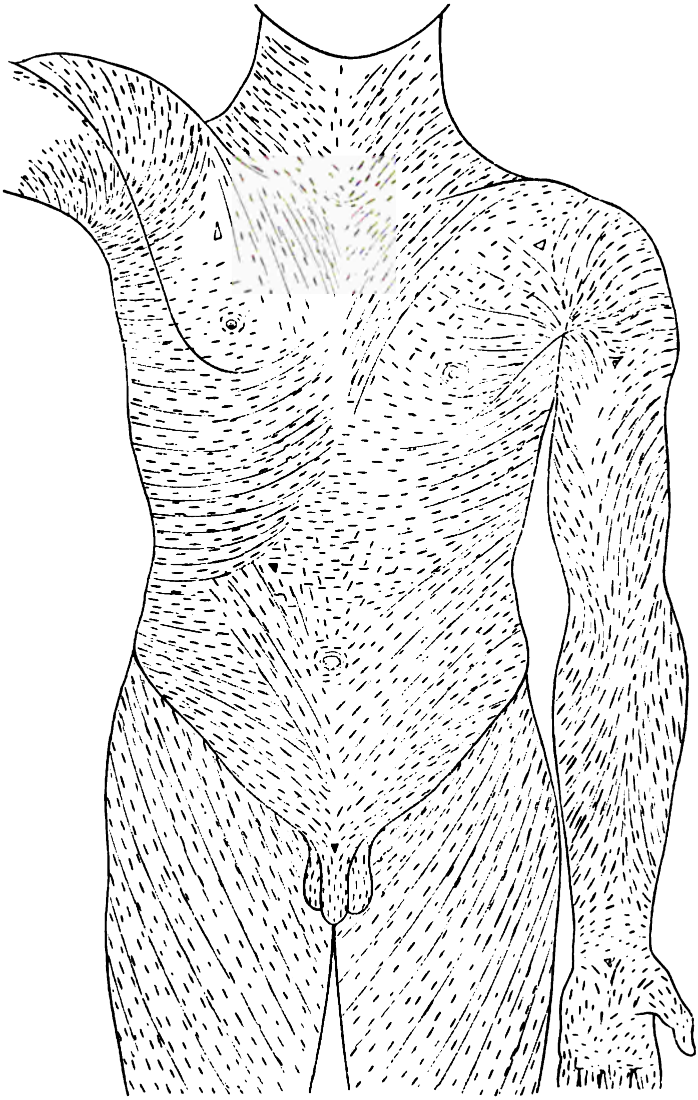
[1] Allg. Anat., Uebersetz. von Pfaff. Leipzig, 1803, II. Theil, II. Abth. S. 199.

[2] Loc. cit.

[3] Ueber Furchen und Falten der Haut, Archiv für Path. Anat. und Phys., Bd. xcii. S. 135; and Ueber Hautfurchen und Papillen, Arch. für Anat. u. Phys., 1882, S. 118.

[4] Monatshefte für prak. Derm., No. 8, 1889.



LINES INDICATING THE

CLEAVAGE OF THE SKIN.

(C. Heitzmann.)

Phillipson[1] classifies the furrows into "primary" and "secondary," the former being due to proliferation of the mucous layer in the form of ridges, occasioned by linear depressions of the horny layer. They everywhere form polygonal spaces, but exist deepest on the palms and soles, and are due to the anatomical relations of the parts. The secondary furrows develop from stretching and cracking of the skin transversely over joints, and are physiological.

The movements of the skin have a marked influence in the causation of the furrows and folds. These exist only where the area of skin is larger than the space occupied by it; in the living subject this occurs normally over joints, and in disease where the corium is thickened by chronic inflammatory processes, and also near cut wounds of the skin. Folds, however, may also be produced mechanically, by shoving the skin together. The number of lines on the surface depends on the retractive power within the skin. These are removed, as is well known, by stretching the skin, which is thus made thinner. Lewinski found under the microscope that the papillæ also disappear upon stretching the skin. The connection between the folds and motion is a double one: whenever the corium is shortened the papillary layer together with the overlying epidermis is thrown into folds. The folds of emaciation are the result of the disappearance of fat leaving an excess of skin upon the affected area.

SUBCUTANEOUS CONNECTIVE TISSUE.

The subcutaneous tissue is the first portion of the integument to attain complete development. During embryonic life it increases in extent more than any other stratum, the fat being steadily and regularly deposited, so that at birth it is highly developed. Allowance being made for extent of surface and bodily weight, it is at this period about five times as thick as the subcutaneous fat of a stout adult (Unna). After birth the fat gradually decreases in quantity, and remains in abundance only at certain chosen points of the body.

The subcutaneous tissue, or STRATUM SUBCUTANEUM, is to be viewed as part of the true skin, the latter merging into it. It is made up of variously sized bundles, or fasciculi, of connective tissue, which cross one another at different angles, thus forming a rhomboidal net-work. The meshes, though variable in size, are generally large, the interfascicular spaces consequently being well defined. It possesses a much looser and coarser structure than the corium, and contains in most regions an abundance of fat, as noted particularly on the mammary glands, palms, and soles. In some regions, however, it is wanting, as upon the auricle (except the lobule) and the eyelid. Where the fat is abundantly deposited the structure is designated PANNICULUS ADIPOSUS, OR ADIPOSE TISSUE.

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[1] Ueber die Herstellung von Flächbildern der Oberhaut und der Lederhaut, Monatshefte für prak. Derm., No. 8, 1889.

COLUMNÆ ADIPOSÆ.

J. Collins Warren[1] describes columnar prolongations of this tissue, in the form of fat columns, passing in a nearly vertical direction from the adipose tissue to the bases of the hair-follicles, especially to those of the fine hairs. The condition is found most highly developed where the cutis is exceptionally thick, as on the back. The axes of these columns are nearly parallel to those of the arrector pili muscles. Besides fat the columns contain a sudoriparous gland, which, as Unna has pointed out, they help to support. They also serve as channels for blood-vessels and lymphatics. From the points whence they ascend from the panniculus a cone-shaped mass of connective tissue is given off from the lower border of the cutis, which penetrates the adipose tissue for some distance. These bundles of fibres have been alluded to by French writers as *cônes fibreux*, and are the attachments of the skin to the parts below. Warren is of opinion that these "columnæ adiposæ" afford flexibility to the dense integument and facilitate the action of the erector muscles, and that they probably play a part also in the nutrition of the upper layers of the skin and its glands; also that in disease they serve as an outlet for morbid elements pressing up from beneath, examples of which have been seen in round-celled sarcoma of the subcutaneous connective tissue, in nævi, and in carbuncle, the peculiarity of the lesion in the last-named disease being accounted for by these structures.

FAT-CELLS AND LOBULES.

The collections or lobules of fat, or "fat-glands," as they may be termed, consist of rounded, oval, or polyhedral fat-cells closely packed together and enclosed in a net-work. According to Biesiadecki,[2] these cells possess a very thin membrane, containing a minute droplet of oil, which keeps the membrane so tightly stretched that it is scarcely discernible during life. The fat may, however, be extracted with ether, when the thin membrane will be seen, with a round nucleus. Each fat-lobule is supplied with a fine plexus of blood-vessels, and each cell is further surrounded by a delicate capillary vessel. Flemming[3] distinguishes three kinds of collections of fat, which may be described according to their relations to the cutaneous vascular supply. The "true fat-lobules" are supplied with large blood-vessels and a system of capillaries surrounding the fat-cells. The so-called "fat-columns" occur along the larger vascular branches, and have but few capillaries, while the "fat-islands" are small groups of fat-cells without blood-vessels of their own, being seldom met with in man. Unna regards the fat-tissue as a dependant of the coil glands, and as a part of the corium which, owing to the activity

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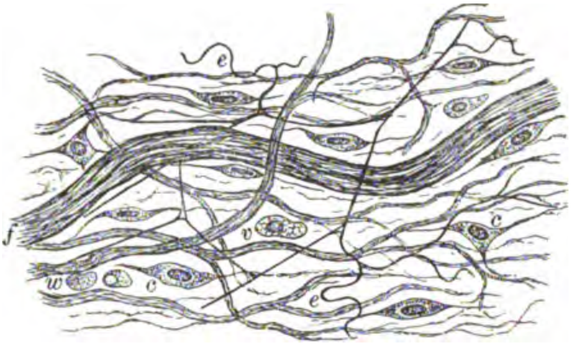
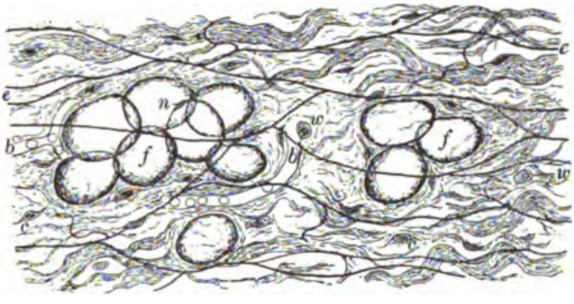
[1] Boston Med. and Surg. Jour., April 19, 1877.

[2] Stricker's Human and Comparative Histology. London, 1872, vol. ii. p. 219.

[3] Monatshefte für prak. Derm., Bd. i. (1882), p. 81 *et seq.* See, also, Flemming "On the Development of Fat-Cells," Max Schultze's Archiv, vol. vii. Part i.



Subcutaneous Areolar Tissue.—*c*, *c*, connective-tissue corpuscles; *w*. migratory cells; *v*, plasma-cells; *e*, elastic fibres. (Piersol.)



Fat-Cells embedded in Subcutaneous Areolar Tissue.—*f*, fat-cells; *n*, nucleus; *c*, connective-tissue corpuscles; *w*, migratory cells; *e*, elastic fibres; *b*, capillary blood-vessels. (Piersol.)

of these glands, has undergone a peculiar transformation. Inasmuch as skin in various regions of the body may be well developed without a layer of fat beneath it, this tissue cannot be regarded as an essential constituent of the integument.

RELATION TO OTHER STRUCTURES.

Large blood-vessels pass through the subcutaneous connective tissue, giving off branches to the corium and the structures contained within it. Pacinian corpuscles, nerve trunks, lymphatics, sweat glands, and the lower part of the hair-follicles of deep-seated hairs, are all found here. Lymphoid cells, especially near the blood-vessels and glands, are also met with. Above it blends intimately with the corium, while its deeper layers are connected with the superficial fasciæ of muscles and the periosteum. In regions where the skin is firmly attached by means of coarse, short bundles, as in the palms, soles, groins, and extensor surfaces of joints, single or multilocular spaces containing sero-mucous fluid, termed BURSÆ MUCOSÆ, exist. Where the skin is firmly attached or is unusually movable and pliable, and muscular, as on the eyelids, the nose, the upper portion of the auricle, the external auditory canal, the penis, and the scrotum, the connective tissue contains few or no fat-lobules in the adult. When the fat disappears from the subcutaneous tissue, the layer becomes a loose reticulum. Its presence or absence determines to some extent the external form of the body.

The subcutaneous tissue plays also a mechanical part in the outer or external economy of the body. It serves as a pad or cushion, and protects the blood-vessels, nerves, and delicate parts from external pressure and injury. It also acts as a regulator of the temperature of the body, being a poor conductor of heat.

BLOOD-VESSELS.

The blood-vessels of the skin and subcutaneous connective tissue have been studied by numerous observers, but in particular by Tomsa.[1] They are subject to great variation. Both the corium and the subcutaneous tissue are highly vascular, having numerous blood-vessels throughout their structure in the form of trunks, branches, and capillaries. Arterioles for the sweat and sebaceous glands and for the hair papillæ also exist. They are largest on the palms, soles, and face, and are more numerous on the flexor than on the extensor surfaces. The arteries are small in proportion to the size of the veins (Hoyer[2]). Their form depends largely upon the cleavage of the locality. Mechanical influences also play an important part in modifying the course of the vessels and the circulation.

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[1] Archiv für Derm. u. Syph., 1873, S. 1.

[2] Archiv für Mikr. Anat., 1877.

ANASTOMOSIS.

There is in all probability a direct passage of the arteries into the veins of the skin. Sucquet[1] described in the skin anastomoses of arteries and veins, which were some years later confirmed by Hoyer[2] with such accuracy in the end of the finger and in the nail-bed that observers are disposed to accept this view. It may be said, therefore, that the arteries of the skin never end as terminal vessels, but in the form of multiple anastomoses. The number of afferent branches and their diameters are variable, the vessels being more numerous and larger where pressure is brought to bear, and their length being greater where the skin is very mobile, as Spalteholz has shown.[3]

PLEXUSES.

Two parallel horizontal plexuses exist, one superficial, in the upper layers of the corium, the other deep, in the subcutaneous tissue. The main vessels of the corium ascend from the subcutaneous tissue, and give off branches laterally in all directions, richly supplying the glands and hair-follicles, as well as the other structure in the corium. In the papillary layer a delicate and highly organized plexus of capillaries exists, affording an abundant supply to this region. The papillæ receive capillary loops, which run through their centre or at their sides, parallel to their long axes. According to G. Thin,[4] the papillæ containing developed nervous structure are supplied with very fine capillary loops, while A. R. Robinson[5] states that papillæ containing tactile corpuscles generally have no blood-vessels. Upon the scalp, where the papillæ are scanty and undeveloped, the arterioles end in a capillary net-work rather than in loops. The superficial plexus also supplies the muscles, the ducts of the sweat glands, and the larger nerves.

LYMPH-VESSELS.

The lymphatics of the skin have been studied by Sappey,[6] Teichmann,[7] Biesiadecki,[8] Neumann,[9] and Klein,[10] and more recently by Unna.[11] Considerable diversity of opinion exists as to the distribution and arrangement of this system in the skin. In the subcutaneous connective tissue

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[1] D'une circulation dérivative dans les membres et dans la tête de l'homme. Paris, 1862, avec 6 pl.

[2] Archiv für Mikr. Anat., 1877.

[3] La Semaine Médicale, No. 47, 1891.

[4] Jour. of Anat. and Phys., vol. viii., 1874, p. 37.

[5] Manual of Dermatology. New York, 1884, p. 17.

[6] Traité d'Anatomie Descriptive, t. ii. Paris, 1876.

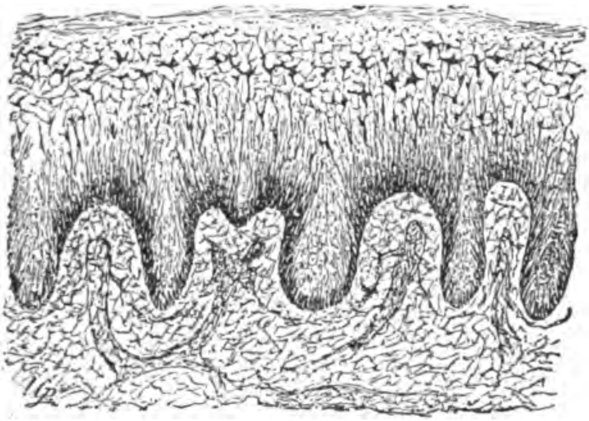
[7] Das Saugadersystem vom anat. Standp. bearb. Leipzig, 1861.

[8] Untersuch. aus d. Path.-Anat. Inst. in Krakau. Wien, 1872. See also Stricker's Human and Comparative Histology, vol. ii. p. 225.

[9] Zur Kenntniss der Lymphgefässe der Haut des Menschen und der Säugethiere. Wien, 1873. Abstract by the author, Phila. Med. Times, vol. iii. No. 43.

[10] The Anatomy of the Lymphatic System (for serous membranes and the lung). London, 1873.

[11] Op. cit.



PERPENDICULAR SECTION OF SLIGHTLY ŒDEMATOUS SKIN, SHOWING PAPILLARY LAYER AND EPIDERMIS, AND INJECTION OF THE LYMPHATIC CHANNELS IN THE SAME. Gold preparation. (UNNA.)

the lymphatics are large vessels, upon which Flemming[1] has demonstrated the rudiments of a muscular apparatus. In the upper strata of the corium they form a net-work of denser and much smaller vessels. Valves occur in the branches coming from the deeper net-work. The direction of the several plexuses is for the most part horizontal, but vessels also pass obliquely through the corium. The veins of the skin are of extraordinary width as compared with its arteries, and Unna believes that the greater part of the lymph which circulates through the skin is taken up by the veins; in furtherance of which statement it may be remarked that œdema of the extremities cannot always be produced by ligating all the lymphatic trunks, whereas it always follows ligation of the veins.

JUICE-SPACES.

The so-called "juice-spaces" may be referred to. Unna regards it as proved that all parts of the skin are supplied with these structures, which may be defined as those lymphatic channels which do not possess an absolutely free outflow into distinct lymphatic vessels lined with endothelium, whether they are devoid of independent walls, as is usually the case, or are provided with them. Lymphatic vessels, on the other hand, may be defined as those canals from which a free outflow into the blood takes place. Juice-spaces exist in the epidermis (a tissue devoid of blood-vessels), where they occur embedded in the interspinous passages of the prickle-cell layer. Axel Key and Retzius[2] succeeded in injecting these spaces from the lymph-spaces of the subcutaneous tissue.

The papillæ are freely traversed by juice-spaces, becoming confluent near their base, at which point the beginning of a lymphatic vessel is generally formed, which ascends in the axis of the papilla to its upper third. The excretory ducts of the coil glands, the sebaceous glands, the prickle-layer of the hair-follicle, and the hair-bed, have the same interepithelial juice-spaces as the epidermis. The oblique muscles of the skin and the coils of the coil glands float in distended lymph-spaces. In the case of the arrectores, these lakes of lymph furnish room for their movements, and in that of the coil glands they supply material for the production of this glandular secretion. The connective-tissue bundles and the fat lobules are all ensheathed by lymph-spaces of various forms. From these observations it is apparent that the system of juice-spaces is extensive and complex. The lymph flows to the epidermis mainly from the apices of the papillæ, thence spreading in all directions through the epidermis and returning to the corium by way of the interpapillary depressions, through the sweat pores of which it may, under some circumstances, be discharged externally also (Unna). Kromayer[3] finds that the pars papillaris cutis possesses its own enclosed lymphatic system, which explains why most of the cutaneous diseases are seated so superficially.

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[1] Quoted by Unna, op. cit., p. 63.

[2] Quoted by Unna, op. cit., p. 60.

[3] Monatshefte für prak. Derm., Bd. xiii. No. 9.

NERVES.

Both medullated and non-medullated nerves exist in the skin, and are especially abundant in the palms and soles and in the last phalanges of the fingers and toes. They pass into the corium with the more important ascending blood-vessels. Bremer found that all the capillaries, even the smallest, were accompanied by nerves. While Tomsa observed that they penetrated into the walls of the capillaries, and Klein and Unna hold that they penetrate into the interior of the capillaries, Bremer takes the view that they end in swellings on the exterior of the vessels.[1]

Medullated nerves terminate, as a rule, in peculiar bodies, so-called "corpuscles," while the non-medullated fibres pass as delicate filaments from the papillary layer of the corium into the mucous layer of the epidermis. In the corium the medullated nerve fibres usually run to the larger papillæ, terminating within the papilla or at its base in the form of tactile corpuscles or corpuscles of Krause. In the subcutaneous tissue they terminate in larger bodies, termed Pacinian corpuscles.

The skin and sensory mucous membranes show in certain regions peculiar and remarkable nerve-endings. In man there are three principal varieties, namely, the Pacinian corpuscles, the corpuscles of Meissner, or tactile corpuscles, and the corpuscles of Krause. They are similar in their structure, being constituted for the most part of a connective-tissue covering with the nerve fibres ending in different forms. Of these the Pacinian corpuscles were the first to be discovered, by A. Vater; next the corpuscles of Meissner, by Meissner and Wagner; and lastly the bulb-corpuscles, or corpuscles of Krause, by W. Krause.

The exact ending of the cutaneous nerves and nerve filaments has been considerably elucidated of late years. Krause was the first to apply the collective name "terminal corpuscles" to the various terminations of sensory peripheral nerves, and enumerated not less than thirteen varieties in the different classes of vertebrata.[2]

MOTOR AND VASO-MOTOR NERVES.

In addition to the sensory nerves, according to Koelliker,[3] the skin possesses MOTOR NERVES on the smooth muscles of the skin, and on all glands which have a muscular layer. Of the VASO-MOTOR NERVES of the skin but little is known with any degree of certainty. They are probably of two varieties, those connected with the central nervous system and those connected with ganglionic plexuses in the immediate neighborhood of the skin itself. The nerve centre is in the medulla oblongata. They are particularly abundant around the arterioles of the skin, and exert an influence upon the vascular, muscular, and glandular cutaneous systems, causing increase or diminution of the circulation, as in flushing and blanching of the skin, in contraction of the muscles, as in cutis anserina, or when the hairs are erected and "stand on end," and in profuse sweating, local or, more rarely, general.[1]

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[1] Archiv für Mikr. Anat., 1882, p. 663.

[2] For recent literature of nerves and nerve-endings, see Quain's Elements of Anatomy, vol. i. Part ii. London, 1891.

[3] Op. cit., p. 171.

Medullated Nerves.—Under this head are to be considered the corpuscles of Krause, the tactile corpuscles, and the Pacinian corpuscles.

CORPUSCLES OF KRAUSE.

The CORPUSCLES OF KRAUSE, or BULB-CORPUSCLES (*"Kolbenkörperchen,"* Krause), in their simplest and at the same time their most marked form, are rounded or elongated bodies composed of a delicate connective-tissue covering, with flat cells, and a clearer, non-nucleated, inner bulb, penetrated in the middle by one or more pale nerve fibres. In structure they resemble closely the innermost parts of the Pacinian body.[2] Numerous other forms, between this and that of the touch corpuscle, occur, and often much resemble this latter body. They should, however, be distinguished one from the other, for, as Krause states, they are never encountered side by side in the same organ. In man these bodies were first described by Koelliker, in the vermilion of the lips, the glans penis, clitoris, and tongue, and designated *"papillæ fungiformes."* This observer regarded them as undeveloped touch corpuscles. They are met with especially in the sensory mucous membrane, and abundantly in the conjunctiva. In man they are usually rounded, and in animals elongate or club-shaped. Sometimes the nerve fibres are more or less tortuous or coiled within the corpuscle. According to Koelliker, the nerves upon which these bodies are seated come from a deeper plexus and give off finer branches, dividing and subdividing towards the surface. They are often seated beneath the papillæ. On the glans penis and clitoris they lie deep under the papillæ, and on the clitoris are larger, and mulberry-shaped, constituting the so-called GENITAL-NERVE-CORPUSCLES of Krause. They have been studied by Axel Key and Retzius, and by Merkel.[3]

TACTILE CORPUSCLES.

These bodies are also called TOUCH CORPUSCLES, CORPUSCLES OF MEISSNER, and CORPUSCLES OF WAGNER. They are fibrous masses, elongate, ovalish or rounded in form, and are found situated in the papillæ of the corium, or, occasionally, in the papillary layer, attached to medullated nerve fibres. As a rule, they occupy the greater portion of the papillæ, and are visible in prepared sections of skin as large, well-defined, firm-looking bodies having a markedly transversely striated or corded exterior. Two or even three corpuscles occasionally occupy one papilla, and, as A. R. Robinson[1] states, frequently a single corpuscle may have the appearance as if two corpuscles were present, this form being produced by a constriction caused by the nerve.

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[1] The subject of these nerves has been studied in particular by Mathias Duval, art. VASO-MOTEUR, in Dictionnaire de Jaccoud, Paris, 1885, p. 520, to which the author would refer for further information.

[2] Ranvier does not describe these corpuscles specially, regarding them as a variety of Pacinian corpuscle. Op. cit.

[3] See Koelliker, op. cit., and Merkel. (See foot-note under "touch-cells.")

The intimate structure of the tactile corpuscles is involved in some uncertainty. According to the studies of Langerhans[2] and Thin,[3] the mass of the body consists of nucleated connective tissue. Medullated nerve fibres, usually one, sometimes two or even three, penetrate the corpuscle at its base or side, and, dividing into delicate fibrillæ, wind with a variable course both around and through the structure. The nerve fibres are seen to advantage stained with gold chloride, the borders being colored dark. The mode of termination has not been definitely ascertained. The corpuscles usually occupy those papillæ which have no blood-vessels, but occasionally they are accompanied by a capillary loop.

The number of tactile bodies varies in different regions of the body; they are most numerous upon the fingers, especially upon the last phalanges. They are found also upon the palms and soles, as well as upon other portions of the body. Meissner,[4] who devoted much time to their study, ascertained that out of 400 papillæ upon a square line of skin of the last phalanx of the finger, 108 were provided with tactile bodies. The same investigator states that they vary from $\frac{1}{20}'''$ (.1058 mm.) to $\frac{1}{10}'''$ (.2116 mm.) in length, and that they measure about $\frac{1}{40}'''$ (.0529 mm.) in width.

PACINIAN CORPUSCLES.

Pacinian corpuscles (so named by Henle and Koelliker after Pacini, an Italian anatomist, who was the first to describe them fully), also called "corpuscles of Vater," are well-defined, grayish, ovoidal, elongate or pear-shaped bodies found upon the cutaneous nerves. In connection with the tendons in man these bodies assume varied irregularly elongate shapes, for the most part pear- or flask-shaped bodies, and may be very numerous, as Sappey[5] has shown. As Langer has proved, they were first seen by A. Vater and described by him as *papillæ nerveæ seu cutanea.* Pacini failed to recognize their relation to nerves (Koelliker). They occur in various regions, but are most numerous on the fingers and toes, especially on the last phalanges, and are found also on the palms and soles. Herbst[6] counted 608 on the whole hand, and nearly as many on the foot, and upon the index finger 95. They occur sparsely upon the backs of the hands and feet, and along the nerves of the arm and forearm. They are met with abundantly on the nerves of the joints. The

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[1] Manual of Dermatology. New York, 1884.

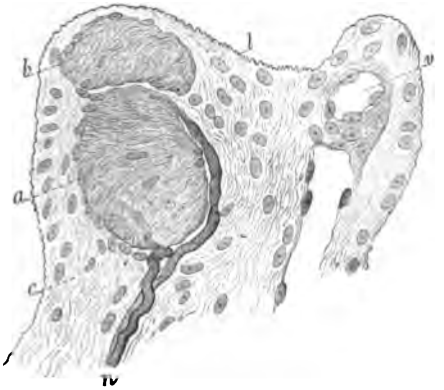
[2] Archiv für Mikroscopische Anat., 1873, p. 730.

[3] Jour. of Anat. and Phys., 1874, p. 30.

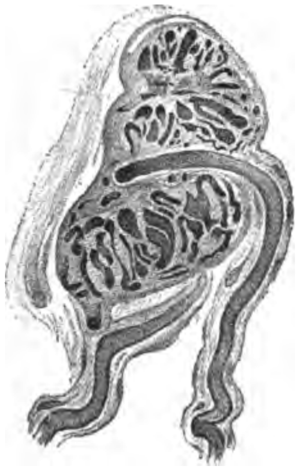
[4] Beiträge zur Anatomie und Physiologie der Haut. Leipzig, 1853.

[5] Traité d'Anatomie Générale. Paris, 1894, p. 113.

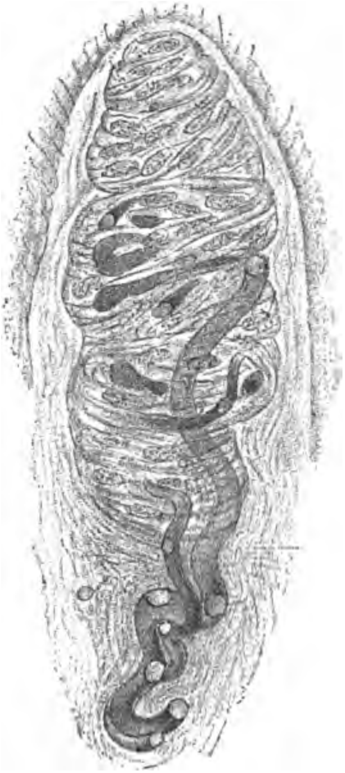
[6] Quoted by Koelliker, op. cit., p. 184.



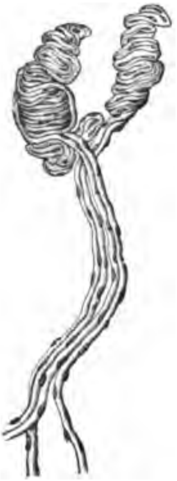
Papilla of Finger of Man, containing a Tactile Corpuscle composed of Two Lobes. Section after the successive action of osmic acid and of alcohol.—*n*, afferent nerve; *a*, lower lobe of the corpuscle; *b*, upper lobe; *c*, connective tissue of the papilla; *l*, folds of the basal membrane on the surface of the papilla; *v*, blood-vessel. (Ranvier.)



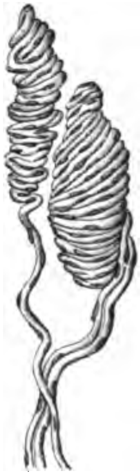
Tactile Corpuscle from Sole of Foot, treated with gold chloride.—Two dark-bordered nerve-fibres enter, one in the upper, the other in the lower half of the corpuscle, and within give rise to numerous non-medullated winding and spirally-running fibres, on which dividing lines and here and there free ends are visible. (Koelliker.)



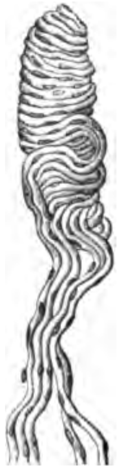
Tactile Corpuscle of a Papilla of Pulp of End of Index Finger, treated with osmium.—Two dark-bordered afferent nerve-fibres enter the lower end, which can be followed as such up to the upper third of the corpuscle and there disappear. The numerous transverse nuclei of the corpuscle belong essentially to the neurilemma of the medullated and non-medullated nerve-fibres. (Koelliker.)



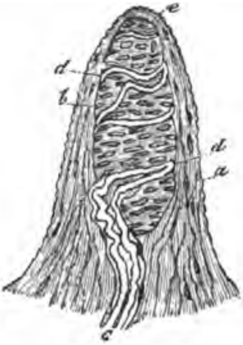
A **Tactile Corpuscle**, formed of a single body, but which, by the employment of reactive agents and under the influence of compression, has been divided into two parts. Of these two lobes, the larger appears to be composed of two lobules superposed and independent but not separable by compression. (**Sappey.**)



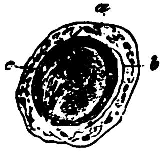
Another voluminous **Tactile Corpuscle**, which has been divided into two lobes; the larger receives two fibres, the smaller only one, which on reaching the inferior extremity turns in a manifestly spiral form. (**Sappey.**)



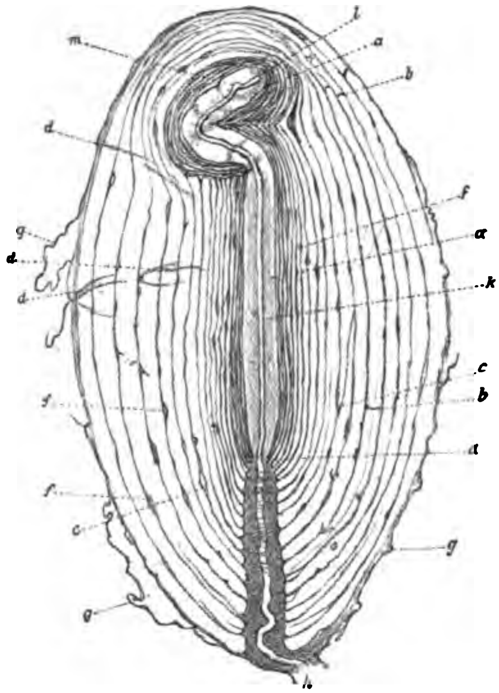
A **Tactile Corpuscle**, much more voluminous than the preceding, with nuclei, and its pedicle composed of five nerve-fibres. On each of these fibres are seen the nuclei of the sheath of Schwann. (**Sappey.**)



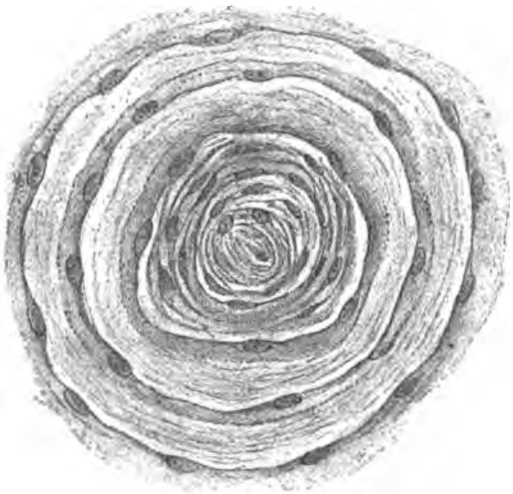
Longitudinal View of a Papilla.—*a*, cortical layer with connective-tissue cells and elastic fibres; *b*, tactile corpuscle with its transverse nuclei; *c*, afferent nerve-branch with nucleated neurilemma; *d*, nerve-fibres, which wind around the corpuscle; *e*, apparent end of the same. Treated with acetic acid. 350 diam. (**Koelliker.**)



Transverse Section of Upper Portion of a Papilla, containing a Tactile Corpuscle.—*a*, cortical layer of papilla with cells; *b*, nerve-fibre; *c*, nucleated covering; *d*, tactile corpuscle. Treated with acetic acid. 350 diam. (**Koelliker.**)



Longitudinal Section of a Pacinian Corpuscle of Man.—*a*, inner bulb; *b*, transverse septa; *c*, longitudinal connections; *d*, divided fibres of the capsule; *f*, nuclei; *g*, outer connective tissue; *h*, nerve-fibre in pedicle; *k* nerve-fibre in inner bulb; *l*, end of the same; *m*, lateral branches. (Koelliker.)



Cross-Section through Middle of Pacinian Corpuscle of a Child.—Nerve-fibre in centre, around which is the capsular covering. The lamellæ show punctated places (longitudinal fibrillæ) and transverse fibrillæ, which are also present in the interlamellar spaces. (Koelliker.)

investigations of Rauber[1] show them to be smaller here than in other regions, and to be especially numerous on the flexor surface of the elbow, and also on the joints of the fingers and other joints. They are found typically developed in many animals, and are numerous in the mesentery of the cat. They are visible to the unaided eye, vary in size, averaging from ½‴ (1.058 mm.) to 2‴ (4.232 mm.), and have their seat in the subcutaneous connective tissue. According to Krause, these corpuscles serve as organs of touch, enabling us to appreciate pressure or traction.

Each Pacinian body is connected with a nerve trunk by means of a medullated nerve fibre, which enters the corpuscle at its lower extremity and passes through the centre of the structure, terminating in one of several ways. According to Biesiadecki,[2] a blood-vessel of considerable size enters the corpuscle in the vicinity of the nerve fibre, and forms a plexus between the outer layers of the capsular envelope.

INTIMATE STRUCTURE.

The intimate structure of the corpuscle is simple. The outer and main portion is composed of connective tissue and connective-tissue corpuscles in the form of a number of concentric, nucleated layers. In accordance with the observations of Klein,[3] Key and Retzius,[4] Schäfer,[5] and others, it may be regarded as consisting of three parts,—the "central nerve fibre," "the core," and the "capsular covering," composed of many layers. The central fibre, a continuation of the entering nerve, but apparently without medulla, retains a uniform calibre throughout the body until it reaches its distal extremity, where it usually becomes enlarged, terminating either in the form of an irregularly sized and shaped enlargement or with pointed, fork-like processes tipped with bud-like swellings. The core, situated immediately around the central fibre, consists in its innermost portion of a clearer, finely granular, softer cord, with delicate nuclei (or cells), which Koelliker looks upon as a simple connective tissue. Its outer part is composed of protoplasmic cells, like connective-tissue corpuscles, with oval nuclei. The capsular envelope which surrounds the core and gives form and bulk to the corpuscle is made up of a number of capsules, from 20 to 60, according to Koelliker, placed in a concentric manner around the central elongated clear mass, or core. The capsule is made up of connective-tissue fibres. These towards the inner or central portion form a longitudinal layer, and towards the outer portion a circular layer, and these two layers are, moreover, penetrated or crossed by transverse or "radial" fibres (Ranvier). In the middle portion of the corpuscle the capsule is made up of only a limited number of circular fibres. A net-work of fine capillaries exists about the pedicle of the corpuscle. The layers of the corpuscle are arranged closely one upon the other, the more external coats being thicker and more loosely bound together. They are separated by septa into smaller and larger spaces, lined with a single layer of epithelium, containing a clear serous fluid, discernible on pricking the corpuscle. Unna[1] succinctly regards the corpuscle as consisting of an enormous enlargement of the sheath of Schwann into concentric lamellæ, having nuclei and lined with endothelium.

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[1] Quoted by Koelliker, op. cit., p. 185.

[2] Op. cit., p. 283. [3] Op. cit.

[4] Archiv für Mikroscop. Anat., Bd. ix., 1873. See also the superb work by Key and Retzius, Studien in der Anatomie des Nervensystems und des Bindegewebes. Zweite Hälfte. Stockholm, 1876.

[5] Quar. Jour. of Micros. Science, April, 1875.

A special form of touch-corpuscle or touch-cell exists in the so called "corpuscles of Grandry," discovered by Grandry[2] in the bills and other regions of birds, and minutely described by Merkel. A medullated nerve is connected with the corpuscle, which on entrance loses its medulla and is distributed in a peculiar manner.

Non-Medullated Nerves.—The researches of Langerhans,[3] Podcopaew,[4] Klein,[5] Koelliker,[6] Ranvier,[7] and others prove that nerve branches, containing one, two, or more nerve fibres, when approaching the surface epithelium are collected into a plexus, the so-called sub-epithelial plexus. From this small groups of minute varicose elementary fibrils come off, which lie close to the under surface of the stratum mucosum, and after having formed a net-work with large meshes—the sub-epithelial net-work —enter the stratum mucosum, where they ascend and ramify, between the epithelial cells, towards the stratum granulosum. They divide and subdivide between the prickle-cells, and terminate either in free endings or in minute bud-shaped swellings towards the granular layer. They do not enter the horny layer. These fibres do not seem to be uniformly distributed in the epidermis, being more abundant in some specimens than in others. Frequently they are observed as a rich plexus. Stained with gold chloride they appear as delicate, filamentous, arborescent structures, with at times fine varicosities on their surface. Unna and Pfitzner believe that the nerves end in swellings, or buds, within the cells of the prickle-layer. This view, however, Koelliker[8] thinks is not proved.

LANGERHANS'S CELLS.

Koelliker, and later Langerhans, found and described peculiar elongate, irregular or star-shaped bodies or cells, without apparent nuclei, situated in the deeper strata of the mucous layer. It was at first thought that they were connected with nerves, but this has been shown not to be the

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[1] Op. cit.

[2] Recherches sur les corpuscules de Pacini, Journ. de l'Anatomie, 1869, p. 393.

[3] Virchow's Archiv, Bd. xliv., Heft. 2 und 3.

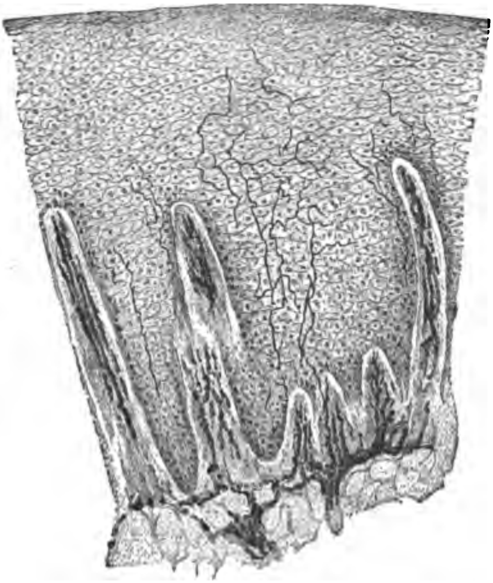
[4] Archiv für Mikroscop. Anat., Bd. v., 1869.

[5] Op. cit.

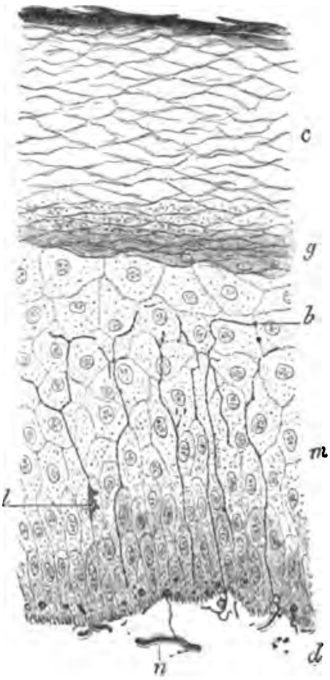
[6] Handbuch der Gewebelehre des Menschen. Sechste Auflage, erster Band. Leipzig, 1889. The author desires to express his indebtedness for much assistance from this authority in the preparation of this article on the nerves of the skin.

[7] Op. cit.

[8] Op. cit., p. 171.



Perpendicular Section through the Skin of the Sole of the Foot, with Nerve-Branchings in the Mucous Layer. The corneous layer is represented only in its deepest parts. Gold preparation. (Koelliker.)



Vertical Section of the Epidermis of the Pulp of a Child aged 50 Days, showing Nerves and Nerve-Endings. Gold chloride preparation.—*d*, corium; *m*, mucous layer; *g*, granular layer; *c*, corneous layer; *n*, nerve supplying the mucous layer; *b*, nerves and nerve-endings; *l*, Langerhans's cell. (Ranvier.)

case. Arnstein[1] regards them as wandering cells, and Merkel as pigment-cells devoid of pigment, while Koelliker (who calls them "Langerhans's cells") believes them to be colorless connective-tissue corpuscles which differ somewhat from lymphoid cells.[2]

TOUCH-CELLS.

Merkel discovered[3] in the epidermis peculiar cells, regarded by him as connected with nerve-endings and as ganglion-cells. They are known as "touch-cells," or "Merkel's cells," and are found in man in various regions, but are more highly developed in some of the lower animals, especially in the snout of the pig (Merkel, Ranvier[4]), and in birds. In specimens stained with osmic acid they are seen as well-defined, oval, nucleated cells. The connection with nerve fibres is apparent only in gold-stained sections, which staining renders the cells themselves less distinct. In man, according to Merkel, they occur in those regions where tactile corpuscles are sparse, as on the abdomen and the shin, but Koelliker found them abundant on the tips of the fingers and on the soles of the feet. As Merkel first pointed out, they are not infrequently met with in the superficial strata of the corium, an observation that has been corroborated by Ranvier.

These cells are looked upon differently by observers, and hence it is difficult to classify them. Merkel believes them to be nerve-cells, while Krause regards them as epidermis-cells which have undergone mitosis, and as having no connection with nerve fibres. Ranvier and Koelliker, however, both incline to the view that they stand in relation to nerve-endings, the latter authority holding the opinion that they are probably transformed cells, having a purpose for some mechanical function.

According to Merkel,[5] the tactile corpuscles and the touch-cells are organs for the finer perceptions, and the bulb corpuscles and Pacinian bodies for localization and common sensation. The free nerve-endings in the hairs may subserve touch as well as sensation, and those in the epidermis both touch and temperature.

MUSCLES.

Both striated and smooth muscles are found in the skin. The former are met with only in certain regions of the body, particularly the face, about the lips, alæ of the nose, eyebrows, and chin, occurring sparsely. They arise from the deeper-seated muscles, pass upwards vertically or obliquely, and terminate in the corium. In many animals the skin is abundantly provided with striped muscles in the form of a cutaneous layer, the so-called PANNICULUS CARNOSUS, enabling the animal to produce voluntary movements of the skin.

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[1] Quoted by Koelliker, op. cit., p. 172.

[2] Op. cit., p. 171.

[3] Arch. für Mikr. Anat., 1875.

[4] Traité technique d'Histologie, Paris, 1890.

[5] Archives of Dermatology, vol. vii. No. 2, p. 191. See also Merkel's work, Ueber die Endigungen der sensiblen Nerven in der Haut der Wirbelthiere, Rostock, 1880. A complete list of books and papers on the subject of the peripheral distribution and modes of termination of sensory nerves may be found in this work.

SMOOTH MUSCLES.

The smooth, or involuntary, muscles exist either as anastomosing plexuses running horizontally, as occurs in the scrotum, or as fasciculi, as in connection with the hair-follicles and the sebaceous glands. The several forms of smooth muscles of the skin call for consideration.

MUSCULAR MEMBRANES.

So-called MUSCULAR MEMBRANES exist in the scrotum, constituting the *fleischhaut*, or *tunica dartos;* also upon the penis, mammary areola, and nipple. The bundles of smooth muscular fibres are deposited in strata in the corium, according to Unna, lying almost perpendicularly to the direction of the cleavage. In the scrotum the fibres are arranged parallel to the raphé. On the penis, nipple, and areola they follow a circular direction, nearly at right angles to that of the cleavage. All these muscles throw the skin into folds when they contract, the cleavage of the particular region being thereby indicated. These muscular membranes, therefore, concern the external configuration of the integument more than they do the fibres of the corium.

SMOOTH MUSCLES OF THE HAIR-FOLLICLES.

The SMOOTH MUSCLES OF THE HAIR-FOLLICLES, discovered by Koelliker, and named *arrectores pilorum* by Eylandt, are cylindrical or broad, single or divided bundles, which originate from the papillary layer, running obliquely, and are inserted into the middle portion of the hair-follicles, encompassing the sebaceous glands. Tomsa and Unna[1] both hold the view that we should regard the attachment of the muscles to the hair as the relatively fixed point, and that to the papillary layer as the movable one. Unna and Balzer[2] describe these muscles as being both surrounded and traversed by a net-work of elastic fibres. These fibres are arranged at both ends of the muscle in large bundles, which serve as a tendon for the attachment of the muscles to the fibrillæ of the corium. The *arrectores pilorum* are seen to perfection in the scalp, mons veneris, scrotum, and perineum. About the areola of the nipple they are arranged in circular layers, becoming more marked from without inward as far as the base of the nipple, and in the nipple they form a net-work. While these muscles are widely disseminated, they are wanting in connection with the hairs in certain regions, as about the eyelashes, eyebrows, vibrissæ, hairs of the lips, and axillæ (Koelliker). The contraction of the muscles produces a general shortening and condensation of the corium. The erectile condition of the skin known as CUTIS ANSERINA, or "goose-skin," is caused by contraction of these

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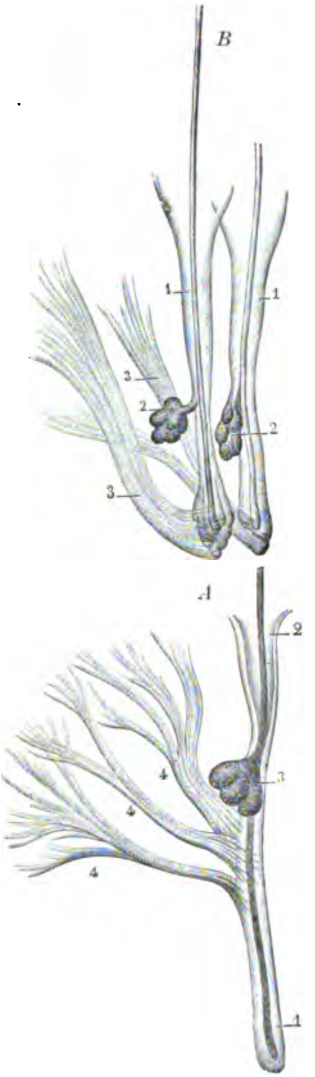
[1] Op. cit., p. 7.

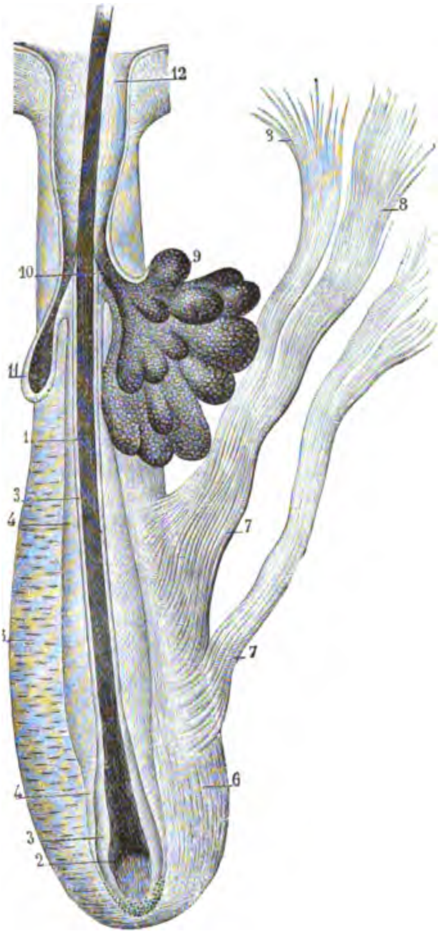
[2] Op. cit. See "Corium."



Smooth Muscles of the Skin.—Their Attachment to the Hair-Follicles, and their Connection with the Sebaceous Glands.

A. Smooth muscles and hair-follicle of the skin of the thigh.—1, bottom of the hair-follicle; 2, its superficial extremity, or mouth; 3, sebaceous gland annexed to the follicle; 4, 4, 4, smooth muscles (three) attached to the follicle immediately below the sebaceous gland.

B. Smooth muscles and hair-follicles of the skin of the breast.—1, 1, hair-follicles; 2, 2, sebaceous glands which open into their cavity; 3, 3, smooth muscles which are inserted into the inferior extremities of the hair-follicles. (Sappey.)



Smooth Muscles and Hair-Follicle of the Scalp.—1, Root of the hair; 2, its bulb embracing the papilla of the hair-follicle; 3, 3, internal sheath of the root extending to the corneous layer of the epidermis; 4, 4, external sheath of the root extending to the mucous layer of the epidermis; 5, tunic with transverse fibres of the follicle with their nuclei; 6, tunic with longitudinal fibres; 7, 7, smooth muscles which are inserted into this tunic; 8, 8, their free extremities which lose themselves in the superficial layers of the derma; 9, sebaceous gland, multilobular, which opens into the superior part of the hair-follicle; 10, excretory duct of this gland; 11, sebaceous gland composed of a single utricle; 12, mouth of the hair-follicle. (Sappey.)

muscles acting suddenly upon the hair-follicles. The muscles act, moreover, not only as erectors of the hair, but as compressors and evacuators of the sebaceous glands, and also upon the excretory ducts of the sweat glands.

Unna has described diagonal smooth muscles of the corium, unconnected with hair-follicles, on the forehead, cheek, and back, the existence of which, however, seems not to have been generally confirmed by anatomists.[1] He asserts that these possess an importance entirely analogous to that of the arrectores as regards their action on the corium, and would regard them together with the erectors of the hairs, under the general name of "oblique tensors of the corium," irrespective of their connection with hair-follicles. The elastic tissue is considered to be the real beginning and end of the oblique tensors of the skin through its entire structure, thus acting upon and regulating all the secretions and fluids of the integument. Viewed in this light, their function as regulators is a most important one.

PIGMENT.

The general coloration of the skin depends largely upon a deposition of pigment, or coloring matter, in the lower strata of cells of the mucous layer of the epidermis. It consists in a slight staining of the cells themselves, with a more intense coloring of the nuclei, and also in the presence of fine granules of pigment in the cells. It appears as a darkened stratum above the papillary layer of the corium. While in the white race pigmentation of the skin is due mainly to the deposit of pigment in the mucous layer, the connective tissue of the corium probably plays the principal part in its production. This observation is particularly noticeable in pathological conditions.

In the white races the horny layer is translucent and grayish or slightly yellowish, and the mucous layer yellowish-white or brownish. This latter hue is most expressed in the nipple and areola, and less marked in the labium majus, scrotum, penis, anus, and axilla. The hue depends largely upon the natural complexion of the individual, and in pathological states is diverse and extremely variable both in degree and in localization. The vascularity of the skin must also be regarded as influencing the complexion, combining with the natural pigmentation to produce the so-called flesh tint. The color of the skin of the white races, according to Kromayer,[2] is due to various circumstances, including the translucency of the epidermis and corium, the anæmic condition of the papillary layer, and the presence of fat in the subcutaneous connective tissue. Unna maintains the view that the white race owes its color largely to the presence of the granular layer.

SEAT OF PIGMENT.

The seat of the pigment of the skin is mainly in the cells of the mucous layer of the epidermis, deposited in the form of finely granular coloring matter, or true pigment granules (melanin). Where the coloration of the skin is not strong, only the deepest stratum of the cells is pigmented; but where the coloration is pronounced, from two to four rows or the whole stratum may be the seat of this deposit. While the horny layer always remains free from pigment granules, it sometimes takes on a darker, yellowish hue. In addition to this, so-called pigment cells are found in the corium, in the white races mainly in the more deeply colored regions of the body, but in the colored races more or less abundantly in all regions.

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[1] Koelliker states that he has not been able to verify this assertion. Op. cit., p. 164.

[2] Deutsch. Med. Wochenschr., No. 25, 1890.

In the negro and in other colored races the pigment cells are highly developed, the whole mucous layer being more or less deeply stained, and even the horny layer discolored. The pigment granules are darker than in the white races, varying from brown to black. At birth, as is well known, the colored races are comparatively unpigmented, the augmented coloration taking place shortly afterwards. This latter subject has been investigated by R. Morison,[1] of Baltimore, who finds that a deposition of pigment in the negro occurs at least as early as one month before birth, as shown by the microscope.

ORIGIN OF PIGMENT.

Concerning the origin of the pigment there has been much discussion, many investigators, as Riehl,[2] Aeby,[3] and Ehrmann,[4] holding the view that no pigment is formed in the epidermis, but that it is carried by leucocytes from the subcutaneous tissue and deposited there. Koelliker's[5] investigations included a number of epithelial structures, from which he concluded that in epidermis and hair the pigment enters by the migration of the pigmented cells of the adjacent connective tissue between the deeper epithelial cells. Koelliker, while he agrees with Aeby in recognizing the importance of the connective-tissue cell as a means of conveying pigment, does not regard the origin of pigment within the epithelium as impossible.

G. A. Piersol's[6] studies lead to the conclusion that in the developing epidermis the earliest pigment appears within mesoblastic cells which have entered the epidermis while still uncolored, and that the pigment is formed within the protoplasm of the cells *in loco*, being neither transported to nor taken up by the cell as preformed granules. Later, after the appearance of pigmented cells within both corium and epidermis,

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[1] Monatshefte f. prak. Derm., Bd. ix. (1889), S. 485.

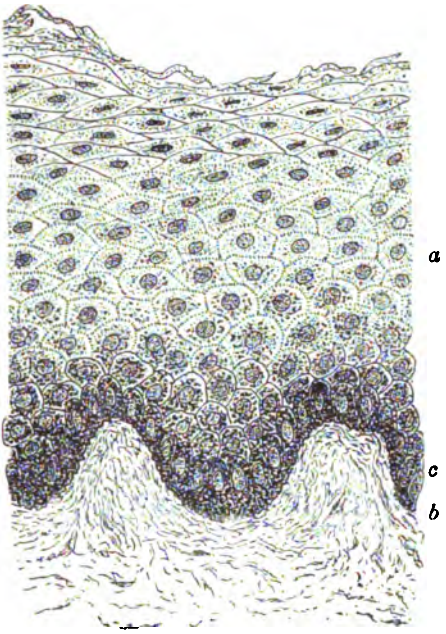
[2] Zeitschr. f. Kl. Med., Bd. x.

[3] Der Herkunft des Pigments im Epithel, Centralb. für die Med. Wissenschaften, No. 16, 1885.

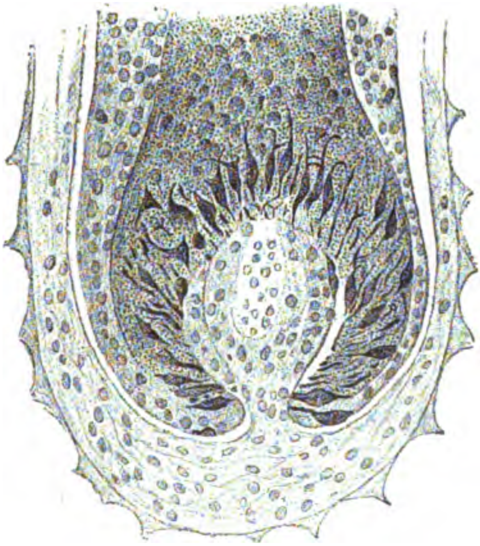
[4] Viertelj. für Derm. u. Syph., 1885.

[5] Woher stammt das Pigment in den Epidermisgebilden, Anatom. Anzeiger, Bd. ii. No. 15, 1887.

[6] Development of Pigment within the Epidermis, Univ. Med. Mag., Aug. 1890.



SECTION OF NEGRO'S SKIN, INCLUDING THE EPIDERMIS (*a*) AND THE PAPILLARY LAYER OF THE CORIUM (*b*); the deepest layers of epidermis (*c*) contain the pigment. (PIERSOL.)



HAIR-BULB OF A HAIR WITH THE SURROUNDING PARTS FROM THE SCALP, WITH BRANCHED PIGMENT-CELLS IN THE HAIR-BULB. (KOELLIKER.)

the pigment cells of the former send processes into the epithelium, and thereby contribute additional pigment to the epidermis, the pigment cells in both localities being identical in nature. This writer holds that there is no conclusive evidence of the origin of pigment within the epithelial cells of the epidermis. Caspary,[1] from his investigations, is of opinion that the presence or absence of foreign pigment cells in the epidermis stands in no relation to the pigmentation of the basal layer of epithelium, and that probably two independent sources of the pigment of the epidermis exist. Experiments made by Karg[2] showed that transplantation of white skin upon negro skin was followed by a growing-in of the pigment cells in a colored man, and that negro skin when grafted on a white man soon lost its dark color.

It would seem, therefore, from the observations of numerous investigators that many colored cutaneous epithelial structures receive the pigment from peculiar pigmented connective-tissue cells of the underlying corium.

EPIDERMIS.

The epidermis, CUTICULA, or CUTICLE, is a membrane or layer composed of epithelial cells which covers the corium in all its parts, adapting itself closely to the various elevations and depressions of this structure. The relations of the epidermis to the papillary layer of the corium are most intimate, the former dipping down in the form of prolongations and forcing itself into the more yielding and plastic true skin. The under surface of the epidermis fits the papillary layer as the fingers of a glove fit the fingers of the hand. It is like wax, moulding itself to the contour of the corium. Where elevations of the corium exist, there are found corresponding sinkings-in, prolongations, or projections downwards of the epithelium. The papillæ are due to the pressure of the epidermis on the surface of the corium.

As has already been pointed out elsewhere, the epithelial layer is distinct genetically from the true skin, and, while the anatomical and physiological relations between the tissues are close, they perform their own functions, each independently of the other. From a dermatological stand-point the epidermis is a most important structure, playing as it does so prominent a part in the pathology of numerous and diverse diseases.

The structure may be viewed in perpendicular or in horizontal sections, or from its outer or its inner surface, the latter view being obtained by separating and removing the layer from the *pars papillaris corii*, as Blaschko[3] has described. Viewing the epidermis according to this method, an entirely different conception of its form and of the formation of the papillary stratum is obtained.

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[1] Archiv für Derm. u. Syph., Heft 1, 1891.

[2] Ueber Hautpigment und Ernährung der Epidermis, Anatom. Anzeiger, Bd. ii. No. 12, 1887.

[3] Beiträge zur Anat. der Oberhaut, Archiv für Mikr. Anat., Bd. xxx. (1887) p. 495.

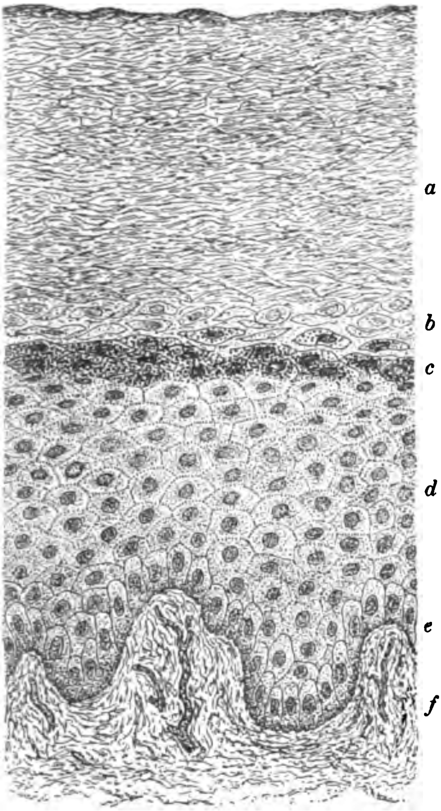
Practically, the epidermis is made up of two main layers, the mucous layer and the corneous, or horny, layer. These layers differ morphologically and chemically, and are separated from each other by a tolerably well defined line of demarcation. In addition to these two principal layers, there remain to be enumerated two of minor importance,—namely, the granular layer and the lucid, or clear, layer.

STRATUM MUCOSUM.

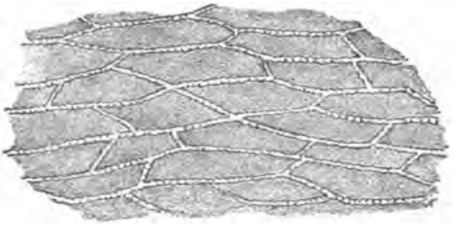
The MUCOUS LAYER, PRICKLE-CELL LAYER, or GERM LAYER (known also as the MALPIGHIAN LAYER, RETE MALPIGHII, RETE MUCOSUM, KEIMSCHICHT (Flemming), STRATUM GERMINATIVUM) may first be considered, being as it is the living and productive stratum. This layer has its seat directly upon the papillary layer below, and above is bounded by the granular layer. It sinks in between the papillæ in the form of interpapillary projections, and where these dip down the layer is of course much thicker than immediately over the summits of the papillæ. The thickness of the layer, as a whole, varies with the locality and with individuals, but is subject to less variation than that of other layers. It presents a slightly undulating surface above, as seen in vertical sections and where the horny layer has been removed, and shows a grayish or yellowish hue. The mass is soft, moist, and mucoid in character. It is composed of polygonal, nucleated, prickled, or chestnut-burr-like cells, which differ in form and size in the several strata. In the deepest layer seated upon the corium they are cylindrical or columnar in form and stand perpendicularly. The lower borders of the cells are pointed or elongated, and give to the line a serrated appearance. The next few layers show elongated, ovoidal, or rounded cells, the form varying with the locality, the disposition here being to assume a rounded form, owing to the more uniform pressure to which they are subjected from below and from above. As the granular layer is approached, they become more elongate transversely and show indications of stratification. Owing to the irregularity of the form and position of the cells in the mucous layer, it is impossible to estimate the precise number of strata of which it is composed. The cells are protoplasmic in their intimate structure, being made up of a soft substance, with large oval or rounded nuclei. Around the cells exists a fluid, occupying the so-called intercellular spaces, which is nutrient in character.

PRICKLE-CELLS.

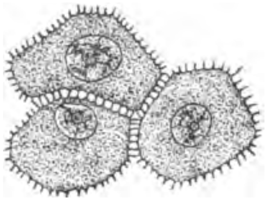
From the surface arise innumerable, variably sized, fine, protoplasmic processes, threads, rays, or prickles, first described, according to Koelliker, by Schrön in 1863. They were also carefully studied by Max Schultze, who called them PRICKLE-CELLS, and later by Bizzozero. Schultze believed that the prickles, or processes, fitted closely into each



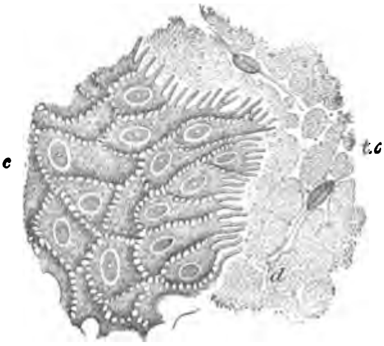
Section of Human Skin from Hand, including the Papillary Layer of the Corium and the Epidermis.—*a*, *b*, *c*, *d*, respectively the stratum corneum, stratum lucidum, stratum granulosum, and stratum mucosum; *e*, layer of columnar cells next the corium; *f*, papillary layer of the corium. (Piersol.)



Vertical Section of the Corneous Layer of the Human Epidermis. $\frac{1}{18}$th Zeiss's Immersion Lens. (Koelliker.)



Prickle-Cells from Middle Strata of the Epidermis. (Piersol.)



Section through the Mucous Layer of the Epidermis parallel to the Surface of the Skin, after injection of blood-vessels with osmic acid and hardening with gum and alcohol.—*c*, mucous layer of the epidermis; *t.c*, *d*, connective tissue of the corium. 1800 diam. (Ranvier.)

other like the teeth of a cog-wheel, whereas Bizzozero concluded from his observations that the processes of two adjacent cells fused together at their points, a view with which Ranvier coincides. Unna regards them in the light of connecting bridges, which view would permit of spaces for the flow of lymph and for the nerve threads which are known to ramify freely through this layer. The existence of a cell-membrane has been much discussed by histologists, the consensus of opinion seeming to be opposed to the view that all the cells are so provided. The processes serve to hold the cells together, and have intimate attachments, for they can be isolated only with difficulty, the prickles often breaking off in the endeavor to separate the cells. This may be done by long immersion in iodized serum, when, as already stated, they resemble in outline a chestnut burr. Under the influence of inflammatory conditions of the corium the intercellular fluid is augmented to a considerable extent, when the prickles are more separated from one another and are consequently seen more distinctly. The older the prickle-cells in the higher layers, the shorter do these processes appear.

As Lewinski[1] has pointed out, the form of the prickle-cells depends on mechanical conditions of pressure, caused by their proliferation on the one hand, and by the counter-pressure of the horny layer on the other. Owing to these causes, great variation in the form of the cells is met with, especially in the middle rows of the stratum. Unna believes that the epithelial cells and their prickles are possessed of independent vitality, and in this sense cannot be regarded as parts of one continuous mass, for the continuity of the prickles may be broken and re-established. The investigations of Flemming[2] show that the epidermic cells always become segmented after a preceding thread-like, or mitotic, metamorphosis of the nucleus. These threads, or mitoses, exist only in the deepest stratum of the mucous layer.

Wandering lymphoid cells are frequently encountered throughout the mucous layer, especially in the lower strata. The cells, especially the lower layers, contain pigment granules, to be referred to elsewhere.[3]

HERXHEIMER'S SPIRAL FIBRES.

Herxheimer[4] describes peculiar flowing SPIRAL FIBRES in the human epidermis and in the epithelium of certain mucous membranes, which appear to advantage when stained by the method discovered by Weigert for staining fibrin and micro-organisms. The fibres begin at the junction of the corium with the epidermis, and are often found in great numbers between the cells. They occur between the cells, and generally have a coiled, zigzag, or spiral form, running parallel with the long axes of the cells, but occasionally run transversely or obliquely. Their form is extremely variable, all manner of transitions from the straight line to the spiral being met with. The most irregular course is found in the middle portion of the epidermis. The fibres divide and branch like trees, large and small, more or less irregular offshoots of variable calibre being encountered. They are more abundant in the deeper strata of the epidermis, and are slightly thicker as the corium is approached, but their calibre is variable. After excluding the possibility of these fibres being cell contours, elastic fibres, nerve fibres, or cement-substance, Herxheimer suggests that this structure perhaps represents a juice-canal system. A. Eddowes[1] has substantiated Herxheimer's discovery, and has added to our knowledge of the subject. According to this investigator, in pathological states the fibres penetrate even into the horny layer. They seem to be more numerous in inflammatory conditions. A peculiar granular matter having the same staining reaction as the spirals is described as existing between the prickle-cells, and where these are abundant the spirals are almost entirely absent, and *vice versa.* Eddowes concludes that these spirals are fibrin in a peculiar form and are continuous with the fibrin of the corium. Kromayer[2] regards these fibres as protoplasmic, and designates them "basal filaments." He describes them as running into the epithelial cells.

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[1] Zur Physiologie des Rete Malpighii, Archiv f. Anat. u. Phys., Phys. Abth., 1883.

[2] Archiv für Mikr. Anat., 1884.

[3] In addition to the authorities cited, these cells have been carefully studied by Martyn (Brit. Med. Jour., June 26, 1875; also Monthly Microscopical Jour., Aug. 1875), C. Heitzmann (Microscopical Morphology of the Human Body in Health and Disease, New York, 1883), E. Oehl (Dermatologischen Studien, Hamburg, 1889), J. Renaut (Compt.-Rend. Hebd. de l'Acad. d. Sc., t. civ., 1887), and M. Ide (La Cellule, t. iv., 1888). See for further references Quain's Elements of Anatomy, vol. i. Part ii. London, 1891.

[4] Archiv f. Derm. u. Syph., 1889, p. 645.

STRATUM GRANULOSUM.

The GRANULAR LAYER is to be viewed as the superficial stratum of the mucous layer, and is composed of two or three strata of coarsely granular cells. In opposition to Zander, Unna holds that the granular layer exists in unbroken continuity over the whole surface of the body. It is a narrow stratum of flattened cells, looking spindle-shaped in vertical sections, with their long axes parallel with the free surface of the horny layer. The nuclei are usually not well defined. The cells refract light very strongly, and therefore seem dark by transmitted and white by reflected light. The granules which characterize this layer were first observed by Aufhammer, and later were minutely described by Langerhans.[3] The relation of these cells to the process of cornification on free surfaces was first pointed out by Unna, who also demonstrated their presence in the ducts of the coil glands and in the mother cells of the inner root-sheath. Waldeyer[4] proved their existence in the medulla of

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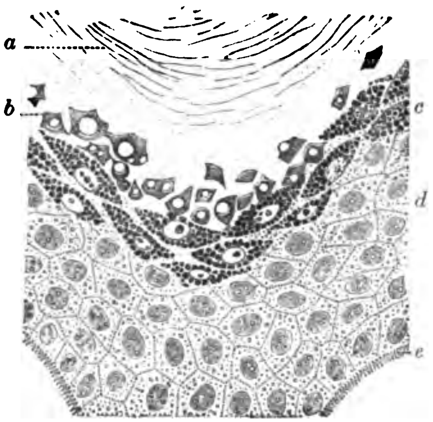
[1] Brit. Jour. of Derm., Oct. 1890.

[2] Monatsh. f. prak. Derm., 1890, ii. 215.

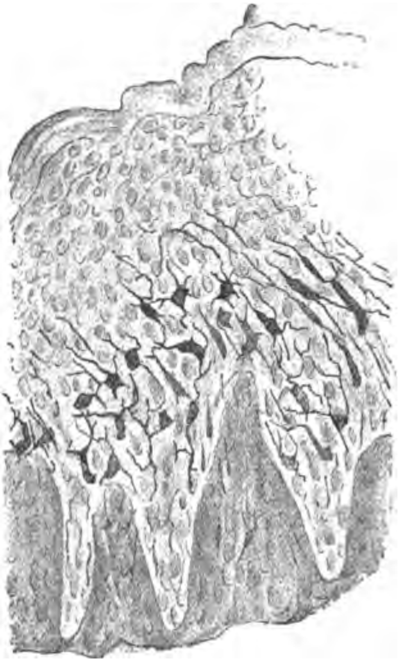
[3] Archiv für Path. Anat. u. Phys., Bd. lviii.

[4] Atlas der menschlichen und thierischen Haare, sowie der ähnlichen Fasergebilde, mit erklärendem Text. Lahr, 1884.



Perpendicular Section through the Epidermis.

a, stratum corneum.
b, stratum lucidum, some of the cells of which are filled with droplets of eleidin.
c, stratum granulosum, full of eleidin droplets or granules.
d, stratum mucosum.
e, dentation of deepest cells, for attachment to the corium. (Ranvier.)



Perpendicular Section through the Skin of the Sole of the Foot, with numerous Langerhans's Cells. From an amputated foot, treated with gold. No nerves visible. (Koelliker.)

the hair and in the horny structure of various animals. They stain well with picrocarmine and hæmatoxylin, the layer thus treated being readily distinguished from the other layers of the epidermis.

ELEIDIN AND KERATOHYALIN.

The so-called "granules" are small and large rounded, elongated, or even rod-like structures, which give the impression of being firm bodies. Ranvier regarded them as containing droplets of fluid, to which he gave the name ELEIDIN. These cells were also studied carefully by Waldeyer, who designated the peculiar substance contained therein KERATOHYALIN, because of the similarity of its chemical behavior with hyalin, a product of degenerative processes of various tissues. F. Buzzi,[1] who has investigated the subject, holds the view that eleidin and keratohyalin should be distinguished from each other, and that they represent two entirely different substances. One, eleidin, appears in fresh sections on the cut surface of the basal horny layer in the form of droplets or pools (*flaques*) of a fluid fat, free and outside of the cells, which may be readily wiped away; the other, keratohyalin, occurs in the form of granules within the cells of the granular layer, which even by cutting into them cannot be wiped away. The reaction with staining substances for the two products is, moreover, different. Both lie in close proximity, but they are distinct. Keratohyalin is essentially a solid substance; eleidin is a fluid. Eleidin is seen best on the sole of the foot.

The question may be asked, What is eleidin? Ranvier[2] regarded it as an ethereal oil ("*huile essentielle*"), but Buzzi, from its reaction with staining fluids, looks upon it as a fatty oil, a glycerin fat. It is not a cholesterin fat (lanolin); nor is keratohyalin a cholesterin fat. In this connection Santi's[3] investigations show that (as opposed to Liebreich's view) in the human skin no cholesterin fat exists, and that, therefore, no lanolin occurs.

KERATOHYALIN AND CORNIFICATION.

The following changes, according to Unna, take place simultaneously in the prickle-cells as they grow old: the nucleus shrinks, the cell becomes filled with granules of different sizes, composed of keratohyalin, this substance being peculiar to the process of cornification; the peripheral zone of the cell becomes differentiated, as a clear border, from the remainder of the cell-body, the intercellular connecting bridges become shorter and stouter, and the cells are in condition to undergo cornification. This process is peculiar to the granular layer, and is an important function. The true cornification of the cells affects only the outer layer of the cell, which is transformed into a horny membrane. The process is confined to the margins of the cells and to their protoplasmic connecting threads. The changes which take place within the cell are secondary, and have no bearing on cornification. Zander[1] is of opinion that keratohyalin and keratin are identical, a view which is strongly opposed by Unna. True keratin may be defined as horn-substance (as of horn of cattle) from which the fat has disappeared. Unna[2] and some others view keratohyalin as a degenerative product of albumen, whose existence occurs simultaneously with that of cornification. According to Behn's[3] studies, there exists only one kind of cornification for the epidermis, the beginning of which process occurs with or before the formation of keratohyalin.[4]

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[1] Monatshefte f. prak. Derm., 1888 and 1889.

[2] Archives de Physiol., 1884.

[3] Monatshefte für prak. Derm., 1889.

STRATUM CORNEUM.

The CORNEOUS, or HORNY, layer is the external layer, which serves to protect the mucous layer as well as the corium, owing to its resistant and horny nature. It is a grayish, opaque structure, composed of polygonal or fusiform cornified cells arranged in strata, which are much alike. It is generally conceded that remnants of nuclei exist in the horny layer, but it is not easy to demonstrate their presence. Zander,[5] who has studied these cells, describes two principal forms or types: one (which is designated type A) found only on the palms and soles and inner surfaces of the fingers and toes, characterized by a highly refractive, apparently homogeneous edge; in the centre a clear, round, or oval spot (looking like a hole in the tissue), which is regarded as an empty nuclear space, can generally be seen. Between the edges and the central cavity a fine net-work exists. Elsewhere over the body the second type (type B) occurs, the horny layer being composed of flat cornified cells arranged in lamellæ. The horny cells show traces of prickles on their surfaces, and are still surrounded by fine intercellular spaces, the borders of the cells having a granular aspect. In sections treated with alcohol or dilute hyperosmic acid, these spaces look like small bright "streets" between the cells, with traces of connecting threads (Koelliker).[6] The treatment of the horny cells with caustic solutions shows them to be vesicular, for they swell up into bladders with a plain limiting membrane. The contents dissolve, and sometimes show a cloudy granular mass. Towards the surface the cells become flatter, drier, and more shrivelled. Upon the free surface they exist as dried, horny, more or less wrinkled or crumpled cells, known as EPIDERMIC SCALES. They measure about $\frac{1}{84}'''$ (.0252 mm.).

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[1] Archiv f. Anat. u. Phys., 1886 and 1888. See also Monatshefte f. prak. Derm., 1893, vol. xvi. p. 97.

[2] See Jessner's remarks in Monatshefte f. prak. Derm., 1893, vol. xvi. p. 97.

[3] Archiv für Mik. Anat., Bd. xxxiv.

[4] See also Blaschko's article, "Ueber den Verhornungsprozess," in Archiv für Physiol. (Du Bois-Reymond), 1889.

[5] Untersuchungen über den Verhornungsprozess, His und Braune's Archiv, 1888, Heft 1.

[6] Op. cit., Fig. 152.

Around the apertures of the gland ducts and follicles the cells of the horny layer assume a circular arrangement, and pass into these depressions in variable directions. The horny layer varies greatly in thickness, being most highly developed on the palms and the soles. Where it is thinnest the cells are flatter.

STRATUM LUCIDUM.

Where the horny layer is thickest, as on the palms and the soles, a deep-seated, bright, transparent, thin, flattened layer of cells exists, known as the STRATUM LUCIDUM, first described by Krause, according to Oehl, to the latter of whom this is generally attributed and who described it more fully.[1] It is composed of from two to four layers of cells, which differ mainly from the cells of the horny layer superimposed in being brighter and more homogeneous. This layer is not always plainly defined, and is not of much importance. It is really a portion of the horny layer. Unna designates it the BASAL CORNEOUS LAYER. It surmounts the granular layer. Zander[2] regards it as being present only in localities (chiefly the palms and the soles) where his type A of cells is found.

EPITRICHIAL LAYER OF THE EPIDERMIS.

The EPITRICHIAL LAYER of the epidermis—so designated and first described by Welcker[3]—consists of large, polygonal, well-defined cells with round nuclei much larger than those of the underlying epidermal layers, which has its prototype in the epitrichium of certain animals. It exists during a stated period of intra-uterine life as an outer layer of cells. Minot[4] and Bowen[5] have shown the existence of this layer, which has not heretofore been universally accepted, Bowen stating that in young human embryos the outermost epidermic cells constitute a distinct histological layer, which disappears by the sixth month over most portions of the body. In certain localities, as the nail, this layer undergoes a keratosis and forms part of the stratum corneum. The nail is a modified portion of the stratum lucidum, and becomes exposed by the loss of the epitrichial layer. As Welcker suggested, there are good reasons for considering this layer homologous with the epitrichium of animals. These cells are the elements described by Zander as rounded "bladder-cells" of the epidermis, which he views as having wandered from the deeper layers of the epidermis to the surface, where they swell in the amniotic fluid. Koelliker regards them simply as superficial cells of the epidermis which have not been transformed into horny lamellæ, and which by perishing have become swollen.

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[1] See "Ueber zwei vergessene Arbeiten der Hautanatomie," von P. G. Unna. Sonderabdruck aus "Dermatologischen Studien." Hamburg, 1889.

[2] Loc. cit.

[3] Ueber die Entwicklung und den Bau der Haut und der Haare bei Bradypus. Halle, 1864.

[4] American Naturalist, June, 1886.

[5] Anatomischer Anzeiger, IV. Jahrgang (1889), Nr. 13 u. 14.

SPIRAL GROWTH OF THE EPIDERMIS.

The investigations of Fischer,[1] Blaschko,[2] and others go to show that the epithelial cells of the epidermis possess a disposition to grow in a curved or spiral form. This observation is borne out by the spiral implantation of the hair-root, the spiral turning of the free hair-shaft, the spiral arrangement of the cuticle of the hair, the spiral winding of the sweat duct, and the spiral arrangement of the epithelial cells in the so-called "epitheliomatous pearls," as well as in many other normal and pathological states of nature. Fischer has also called attention to the spiral turning of growing organs in general as establishing a law.

SEBACEOUS GLANDS.

The sebaceous glands (*glandulæ sebaceæ*), known also as SEBIPAROUS GLANDS, are racemose, or acinous, in structure, and have their seat in the corium. They are for the most part connected with hair-follicles, into which they pour their secretion, the sebaceous matter. They are found upon all regions of the body where hairs exist, and hence are sometimes called "hair-follicle glands;" but they also occur on the border of the red of the lips, the labia minora, and the glans penis and prepuce, though they are absent, according to Koelliker, on the glans and prepuce of the clitoris. Several forms of glands are met with, the simplest being short, elongated, pear-shaped tubules; in other places they are composed of two or three pouches connected with a short pedicle, while in other localities the pouches are even more clustered, the formation being distinctly bunched,—racemose. Numerous variations of form are encountered.

Accompanying the strong hairs, the glands are seated on the sides of the hair-follicle, into which they open by means of a short duct. They may be looked upon as appendages of the hair-follicle. In the case of lanugo, the duct and gland are often of the same size as, or even larger than, the hair-follicle. The glands of the nose, occurring here with lanugo, are highly developed, large, and of unusual form, having sometimes, according to Krause, as many as twenty acini. Those upon the concha of the ear, the penis, and the areola of the nipple are also large. The largest, however, exist upon the mons veneris, labia majora, and scrotum.

The gland is a simple structure, and consists of a secreting portion and a duct. It possesses a connective-tissue covering which arises from the hair-follicle or from the corium, lined with a thin membrana propria, upon which are seated cubical epithelial cells in a variable number of layers. The cells in the centre of each acinus undergo fatty degeneration, the process of fat-formation taking place in the central portion only of each cell, which eventually ruptures, the oil being poured out, mixed

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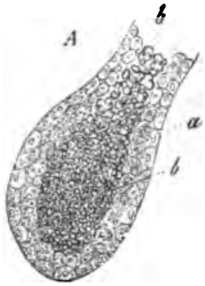
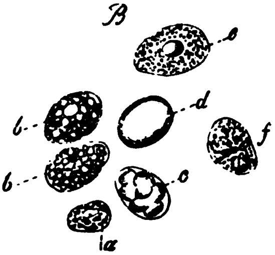
[1] Das Drehungsgesetz beim Wachsthum der Organismen. Cassel, 1886.

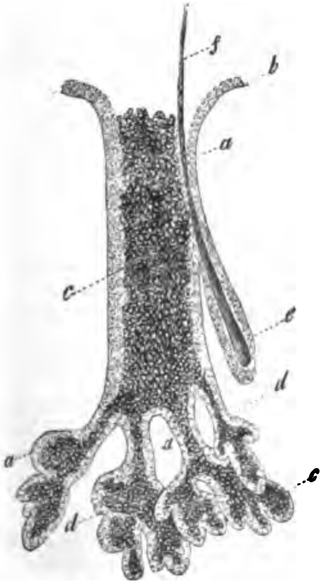
[2] Beiträge zur Anat. der Oberhaut, Archiv für Mikr. Anat., Bd. xxx. (1887).



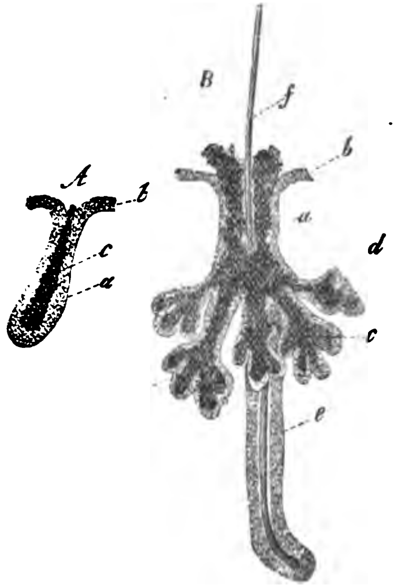
A, **Gland-Vesicle, or Acinus, of a Common Sebaceous Gland.**—*a*, epithelium defined, but without a covering of membrana propria, and immediately passing into the cells containing fat. *b*, within the tubular gland. (**Koelliker.**)



B, **Sebum Cells from a Tubular Gland.**—*a*, smaller, poor in fat, rather epithelial, nucleated cells; *b*, cells rich in fat, without visible nuclei; *c*, cells in which the fat has begun to run together; *d*, cells with droplets of fat; *e*, *f*, cells the fat of which has in part escaped. (**Koelliker.**)

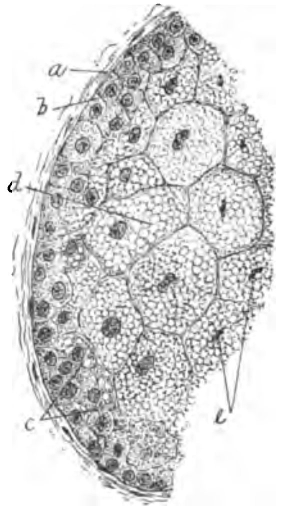


A Larger Sebaceous Gland of the Nose, with a small hair-follicle emptying into it. 50 diam. (**Koelliker.**)

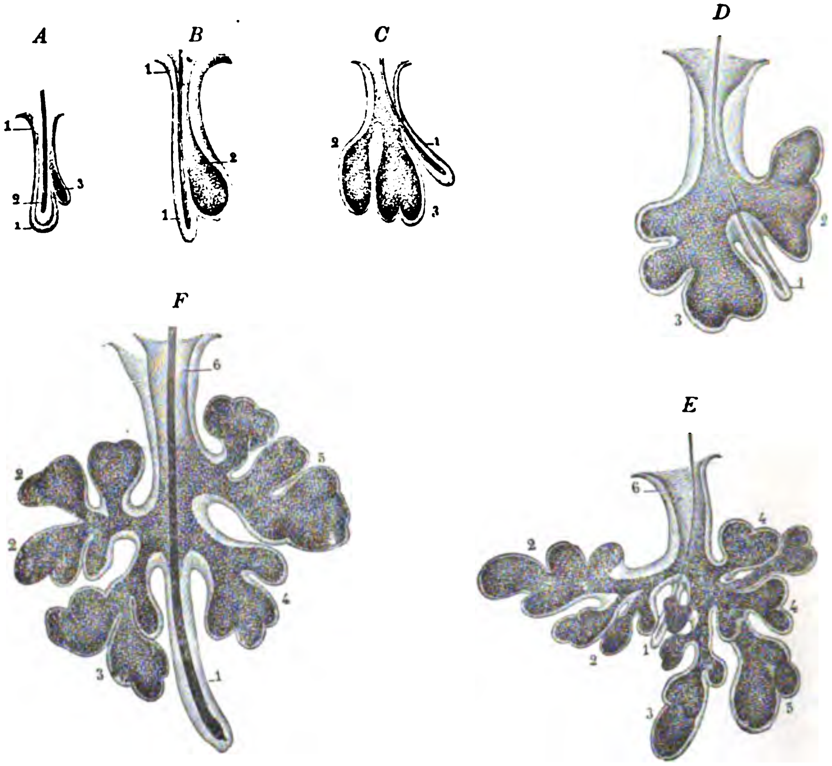


Sebaceous Glands of the Nose.—*A*, Simple tubular gland without a hair.

B, Composite gland, which has a common aperture with the hair-follicle; *a*, glandular epithelium, in connection with *b*, the mucous layer of the epidermis; *c*, contents of the glands,—sebaceous cells and free fat; *d*, single lobes of the gland; *e*, hair-follicle (and root-sheath) with the hair; *f*, hair. 50 diam. (**Koelliker.**)



Section of Portion of Sebaceous Gland from Human Scalp, including part of Acinus.—*a*, membrana propria; *b*, peripheral layer of cuboidal cells; *c*, elements in which fatty metamorphosis is beginning; *d*, cells filled with fatty particles and exhibiting intracellular net-work; *e*, nuclei of cells. (**Piersol.**)



Sebaceous Glands of the Skin of the Face, showing Different Degrees of Complication. All these varieties occurred in a single thin section of the integument.

A. Gland in a State of Simple Vestige.—1, rudimentary hair-follicle; 2, lanugo contained in this follicle; 3, gland formed of a single very small pouch opening at the middle portion of the follicle.

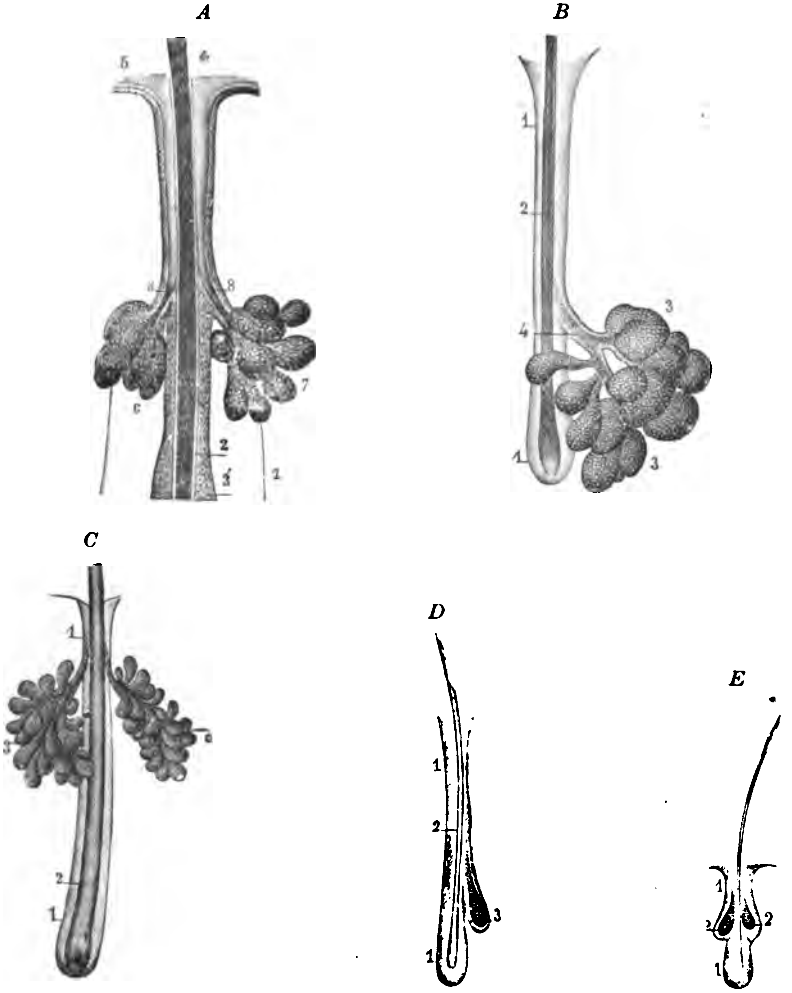
B. Gland also composed of a Single Pouch, but more developed than *A.*—1, 1, hair-follicle; 2, sebaceous gland.

C. Gland formed by Two Unequal Pouches.—1, hair-follicle; 2, simple pouch; 3, larger pouch, with vestige of segmentation.

D. Sebaceous Gland composed of Two Lobules.—1, hair-follicle; 2, lobule composed of three pouches; 3, another lobule, larger, formed of four pouches, of which two are completely developed and the other two are in a growing state.

E. Sebaceous Gland composed of Three Lobules.—1, hair-follicle; 2, 2, first lobule; 3, second lobule; 4, 4, third lobule; 5, two pouches which open by a common duct into the preceding lobule, of which they are part; 6, excretory duct.

F. Large Sebaceous Gland composed of Four Lobules.—1, hair-follicle, much more highly developed than those of the preceding glands; 2, 2, first lobule; 3, second lobule; 4, third lobule; 5, fourth lobule; 6, excretory duct of the gland, and the hair which traverses it. (Sappey.)



SEBACEOUS GLANDS OF THE FIRST CLASS (SAPPEY).

SEBACEOUS GLANDS OPENING INTO THE CAVITY OF A HAIR-FOLLICLE.

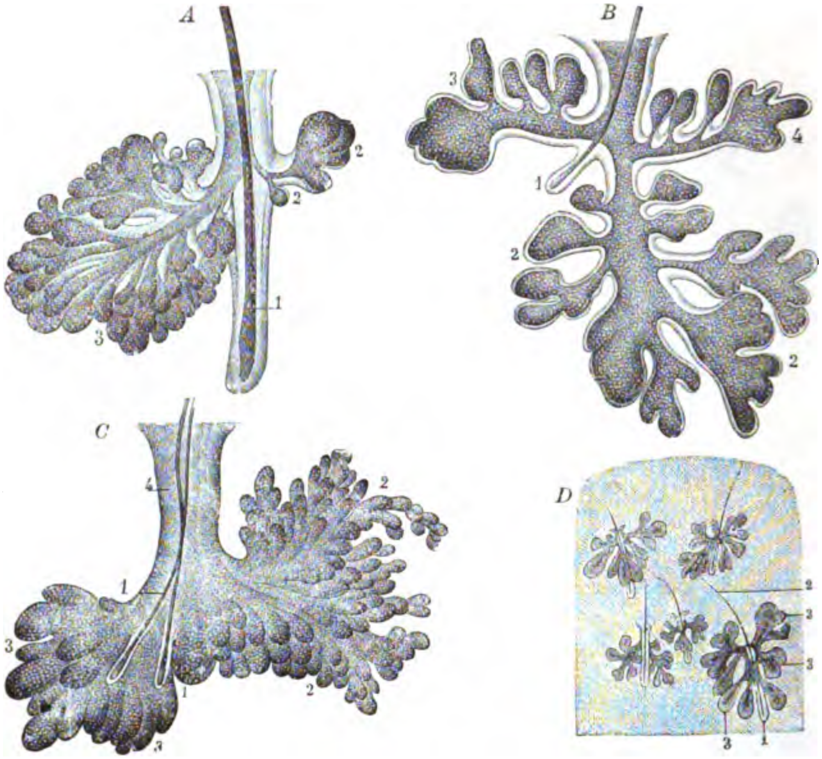
A. TWO SEBACEOUS GLANDS OF THE SCALP OF UNEQUAL SIZE.—1, contour of the hair-follicle, of which the inferior portion has been cut off; 2, 3, the internal and external sheaths of the root; 4, a hair; 5, mouth of the hair-follicle; 6, unilobular sebaceous gland; 7, sebaceous gland more complicated than the preceding; 8, 8, excretory ducts of these glands.

B. A SEBACEOUS GLAND, VERY COMPOSITE, OF THE SKIN OF THE EYELID.—1, 1, hair-follicle; 2, a hair; 3, 3, bilobular sebaceous gland; 4, its excretory duct.

C. ANOTHER SEBACEOUS GLAND OF THE SKIN OF THE EYELID, EXTREMELY SIMPLE.—1, 1, hair-follicle; 2, a hair; 3, gland represented by a single utricle.

D. SEBACEOUS GLANDS ANNEXED TO A HAIR-FOLLICLE OF THE EYELID.—1, 1, hair-follicle; 2, eyelid, of which the free extremity has been cut off; 3, 3, very composite glands opening at a point near the mouth of the hair-follicle.

E. SEBACEOUS GLANDS OF THE ROOT OF THE NOSE.—1, 1, hair-follicle; 2, 2, two uniutricular glands of the same size, opening on the same level at diametrically opposite points of the follicle. (SAPPEY.)



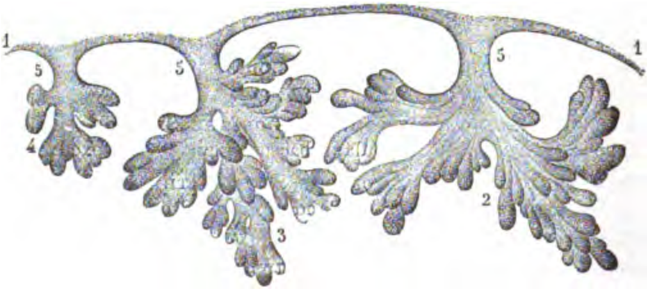
Sebaceous Glands of the Second Class (Sappey).

A. Average sebaceous gland of the ala of the nose, composed of a single lobe, very complicated.—1, hair-follicle and its hair, both presenting a certain degree of development; 2, 2, rudimentary sebaceous gland, opening into the cavity of the hair-follicle; 3, sebaceous gland offering the aspect and arrangement of a bunch.

B. Average sebaceous gland of the ala of the nose, composed of three lobes.—1, hair-follicle; 2, 2, principal lobe of the gland; 3, 4, two other lobes more simple.

C. Large sebaceous gland of the areola of the breast.—1, 1, two hair-follicles in a state of vestige; 2, 2, large lobe of a very complex structure; 3, 3, another lobe, of which the arrangement is a little less complex; 4, excretory duct of the gland.

D. Nine sebaceous glands of the lachrymal caruncle.—1, hair-follicle of one of these glands; 2, hair which it contains; 3, little lobules of which it is composed. (Sappey.)



Sebaceous Glands of the Third Class (Sappey).

Three Glands of the Nipple.—1, 1, surface of the nipple; 2, sebaceous gland composed of two lobes, each consisting of two lobules; 3, another gland, composed also of two lobes of a complicated arrangement; 4, glandule, very small, and much more simple than the preceding; 5, 5, 5, excretory ducts by which the three glands open upon the surface of the nipple. (Sappey.)

with more or less epithelial *débris*, through the excretory duct into the follicle in the form of SEBUM or SEBACEOUS MATTER. This product of the glands is an oily, fatty, semi-fluid, amorphous substance, of a whitish or yellowish color.

The sebaceous glands develop from the outer root-sheath of the hair-follicle between the fourth and fifth months of intra-uterine life, in the form of flask-shaped swellings with cavities. Fatty degeneration of the epithelial cells (the secretion) begins early. Blood-vessels and capillaries supply the glands, the latter surrounding them as a net-work. The arrectores pilorum muscles compass the glands and aid in expressing their contents. The function of the glands is to lubricate the hairs.

MEIBOMIAN AND TYSONIAN GLANDS.

The MEIBOMIAN GLANDS are embedded in the free borders of the eyelids, and are the largest sebaceous glands met with. They differ from other sebaceous glands chiefly in their elongate form. The TYSONIAN GLANDS are found upon the glans penis and the inner surface of the prepuce. They are inconstant, sparse or numerous, variable in development, and usually may be seen with the naked eye as small whitish points on a level with the skin. They are unconnected with hairs, opening on the free surface. The smegma which forms in this locality, and which was formerly regarded as being a product of these glands, is now known to be mainly an exfoliation of the horny layer of the epidermis. Upon the labia minora also exist large glands without hairs, those on the labia majora being connected with hair-follicles. Koelliker has also described sebaceous glands on the red border of the lips, especially the upper lip, and near the angle of the mouth. The glands just referred to may, as Unna suggests, be grouped and designated "sebaceous glands of the mucous orifices."

SWEAT GLANDS.

The SWEAT, SUDORIPAROUS, or COIL GLANDS (*glandulæ sudoriparæ, glandulæ glomiformes*) are convoluted coiled bodies seated in the subcutaneous tissue. They are simple tubular glands, coiled into a more or less globular form, which open upon the free surface by means of a narrow canal called the EXCRETORY DUCT, which begins within the body of the coil. Two kinds of glands, large and small, are met with, the former distinguished by their great thickness and length, and also by constrictions and irregular dilatations. They are rounded or flattened, yellowish or yellowish-red, translucent bodies, variable in size. As a rule, they measure from 0.3 to 0.4 mm. On the eyelids, skin of the penis, scrotum, the arched, exterior part of the ear, and the nose, they average from 0.06 to 0.1 mm. In the areola of the nipple and near it, at the root of the penis between the scrotum and perineum, in the external auditory canal (ear-wax glands), and in the groin, they measure from 1 to 1.7 mm., and in the anal region (circumanal glands) from 0.6 to 0.7 mm.

in width to 1 to 2 mm. in length. In the axilla they are still larger, and measure in thickness from 1 to 3 mm. and in width from 2 to 7 mm. (Koelliker). They have their seat mostly in the reticular layer of the corium, surrounded by fat and loose connective tissue, and, more rarely, in the subcutaneous tissue, or at the junction of these two layers, as is the case in the areolæ of the breast, eyelids, penis, axillæ, scrotum, palms, and soles. Upon the palms and soles they are arranged in rows at the base of the ridges of the corium, tolerably equidistant one from another; in other localities they occur, with some exceptions, distributed in a pretty regular manner, one or two in a reticulum of the corium. In the axillæ they form an almost continuous layer just beneath the true skin, above which smaller glands in variable number are found. In the external meatus of the ear (*glandulæ ceruminosæ*) they exist between the skin and the cartilage in dense subcutaneous connective tissue, without much fat. Around the opening of the anus, Gay first described large, annularly arranged glands, called CIRCUMANAL GLANDS. The eyelids also contain peculiar glands known as GLANDS OF MOLL, which must be regarded as a variety of sweat gland. They are broad, somewhat convoluted tubules, without coils, lined with large cylindrical cells, provided with muscles, which usually empty into the follicles of the cilia. The caruncula lachrymalis, according to Waldeyer, exhibits a transitional form between these modified sweat glands and the usual variety of sweat glands.

DISTRIBUTION AND NUMBER.

The distribution of the sweat glands is extensive, and, according to Hoerschelmann,[1] they exist almost everywhere. Klein and Robinson failed to find them in the glans penis and on the margin of the lips. Their number is large, and has been estimated by Krause at 2,381,248 for the whole surface. Upon the back and cheek from 400 to 600 to the square inch have been counted by Krause, and upon the palms and soles from 2600 to 2736 to the same space.[2] According to the calculation of Sappey,[3] there exist upon the palm of the hand and the sole of the foot an average of 106 in a space of 2.5 mm. square. They are three and a half times as numerous here as on other parts of the body. For the entire surface of the body Sappey places the number at over 2,000,000. Hoerschelmann, a more recent observer, gives still larger figures.

STRUCTURE OF THE GLAND.

The sweat gland consists of a single tubule wound or coiled into a rounded or oval body, the tubule in the case of the smaller glands having a tolerably uniform calibre, and terminating on the surface or in the interior of the gland in a swollen blind end. In the larger glands of the axillæ, Koelliker describes the tubules as being divided and sub-

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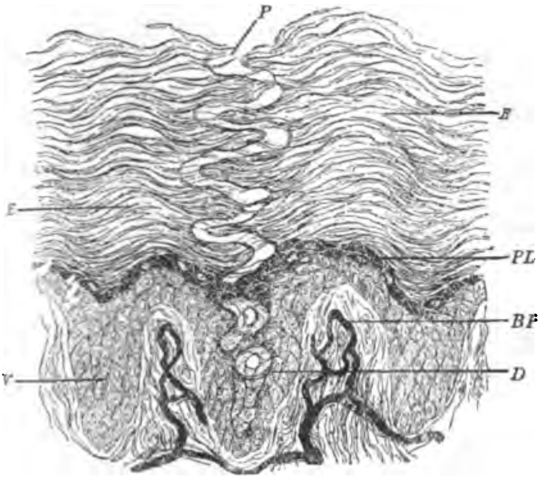
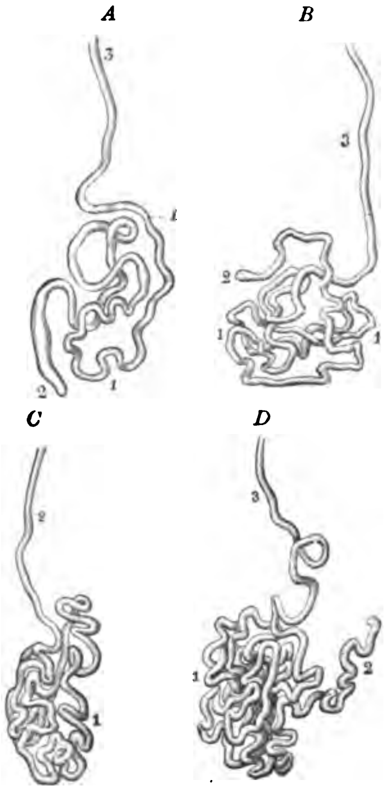
[1] Inaug. Diss., Dorpat, 1875; Centbl. f. Med., No. 11, 1876.

[2] See Koelliker, loc. cit. [3] Traité d'Anat. Descriptive, t. iii. p. 594. Paris, 1877.



Sweat-Duct traversing the Epidermis.—*BP*, papilla of the corium with injected blood-vessels; *V*, interpapillary space; *D*, duct in the mucous layer; *E*, *E*, corneous layer; *PL*, granular layer, stained with carmine; *P*, excretory duct with corkscrew windings in the corneous layer. 150 diam. (C. Heitzmann.)



Sweat-Glands, showing the Coils and the Endings.

A, Sweat-Gland of the Palm of the Hand.

B, Sweat-Gland of the Back of the Hand.

C, Sweat-Gland of the Scalp.

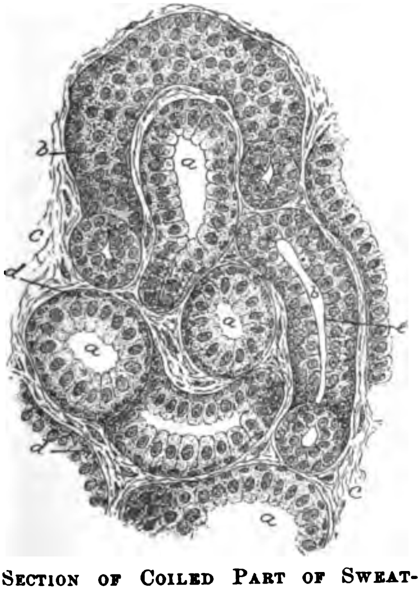
D, Sweat-Gland of the Skin of the Thigh.

A.—1, 1, body of the gland; 2, the initial extremity of the secreting tube; 3, excretory duct of the gland.

B.—1, 1, body of the gland, more complicated than the preceding, but in great part, however, also unrolled; 2, initial ending of the secreting tube which forms the glomerule by its superposed flexuosities; 3, excretory duct of the gland.

C.—1, 1, body of the gland formed by the convolutions of the secreting tube applied one upon another; the initial extremity of this tube is hidden from view; 2, excretory duct of the gland.

D.—1, body of the gland, more voluminous and more complicated than the preceding, because it is formed of a longer and more flexuous tube; 2, initial part of the tube; 3, excretory duct. (Sappey.)



Section of Coiled Part of Sweat-Gland from Human Skin.—*a*, *a*, secreting portion of tubule, cut in various directions; *b*, *b*, parts representing beginning of duct; *c*, intertubular connective tissue; *d*, layer of involuntary muscle inside the basement membrane; *e*, cubicular border. (Piersol.)

divided into numerous fork-shaped branches terminating in blind sacs. The secreting tubules of the glands are made up of three distinct layers, a covering or investing membrane of connective tissue, a layer of smooth muscle fibres, and epithelium. The first is composed of connective-tissue fibres and connective-tissue nucleated cells, running parallel with the long axis of the canal, the inner portion constituting the membrana propria (Virchow).

The muscular layer exists upon all the glands. It is well defined upon the larger glands, the elements occurring in the form of spindle cells with a single nucleus, which are easily isolated, especially in the glands of the axillæ. They are band- or spindle-shaped, with a rounded or elongated nucleus, which is situated usually to the inner side of the fibres, from which it is easily loosened. The substance of the fibre-cells is homogeneous or finely striped, or may possess delicate transverse lines, and sometimes contains dark, even yellow or brown, fat-granules. The muscle fibres lie immediately beneath the epithelium, without, according to Koelliker, an intervening membrana propria.

The epithelial layer, seated directly upon the basis of the muscle layer, is composed of a single row of cells, usually cylindrical in form, but in some localities flattened. The cells possess nuclei and one or two nucleoli, the latter being usually in the basal portion of the cells. As Heynold has shown, the cells possess on their free surfaces a delicate, defined limiting membrane, which in the case of the larger glands is so firm an investment as to be looked upon as almost an actual cuticle.

The sweat glands are abundantly supplied with blood-vessels, in the form of a basket-like net-work on the exterior, the vessels penetrating between the coils, which show well by injection. Tomsa states that these vessels arise from independent branches of the cutaneous arteries, build a capillary net-work of their own, and have a separate system from that of the upper strata of the corium. The excretory duct is supplied with arterioles from the arteries of the papillary layer. Nerve fibres occur in a rich net-work around the glands and capillaries, as has been shown in gold preparations by Ranvier. Some of these fibres penetrate the membrana propria and reach the muscular layer.

The first rudiments of the sweat glands appear in the fifth month of intra-uterine life, in the form of conical epithelial processes into the corium, and develop much like the glands of the hair-follicle. In the sixth month they have become elongated into slender appendages with a club- or hook-shaped termination, the beginning of the coil. In the seventh month the canal appears, extending towards the epidermis, on the surface of which an opening, the sweat-pore, is formed.

EXCRETORY DUCT.

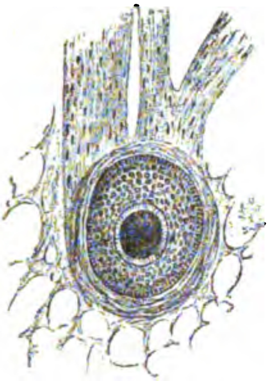
The EXCRETORY DUCT begins in the interior of the coil, and winds its way upwards through the corium and between—never through—the papillæ into the epidermis; through the epidermis it pursues a winding spiral course until the surface is reached, where it ends with a rounded funnel-shaped aperture, the so-called SWEAT-PORE. Occasionally it opens into the hair-follicle, as in the glands of Moll of the eyelids. The length of the duct varies with the situation of the gland and with the thickness of the skin. The duct at its beginning is always narrower than the secreting tubule, but beyond this point it is of uniform calibre until the entrance into the mucous layer of the epidermis, where, as a rule, it doubles in diameter and loses its sharp outline.

The duct possesses up to contact with the mucous layer of the epidermis or the hair-follicle a connective-tissue investment with elongately placed nuclei, and a membrana propria, lined with a double row of cells except in the widened part through the epidermis. The interior is composed of the continuation of the cylindrical cells of the secreting canal, and consists of pavement epithelium with round nuclei. In the mucous layer the duct is distinctly lined with cells of the inner cell-layer, but shows signs of a cuticular covering and a concentric arrangement with flattening. In this region eleidin granules are also met with in the cells. Above this point in the horny layer the cells assume a distinctly concentric arrangement around the openings, or pores, of the ducts. The pores are regular or irregular in their arrangement according to the region, and where large, as in the palms and soles, may be seen with a low magnifying power.

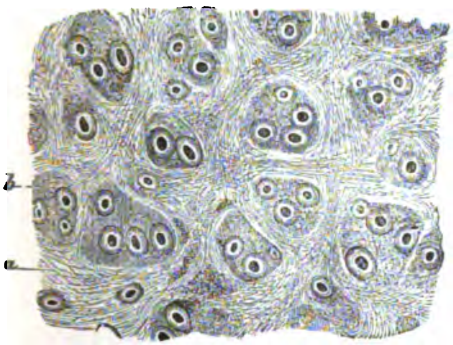
HAIR-FOLLICLE.

The hair-follicle is a depression in the corium, adapted to receive the hair. It is an elongated cylindrical sac, or pouch, dipping down into the corium, and even into the subcutaneous tissue, and is to be viewed as a continuation of the corium with its epidermic covering. Its upper portion, termed the MOUTH, is funnel-shaped, and opens directly upon the free surface. Just below the line of the papillary layer is a constriction, called the NECK, which is the narrowest part of the follicle and is the point where the orifice of the sebaceous gland enters. The follicle now enlarges somewhat, and finally terminates in a bulbous extremity accommodating the hair-bulb and the hair-papilla. It is placed more or less obliquely in the corium, usually pursuing a straight or more or less curved course, but in some localities, as, for example, the lips and the eyebrows, it is markedly curved. The depth of the follicle varies greatly in different regions, Koelliker estimating it at from 2 to 7 mm. Follicles occur singly or in groups, the latter being the case especially upon the scalp, where two or three or even as many as five may exist together. From the base of the follicle is developed the hair-papilla.

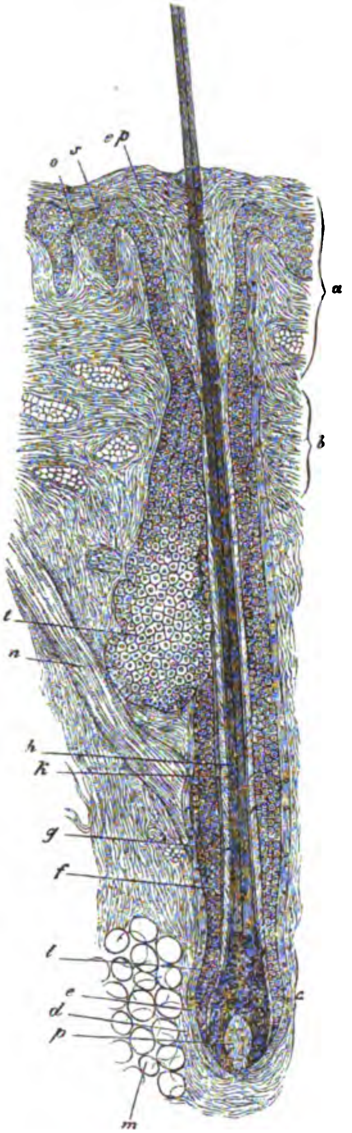
If the connective tissue of the derma and the epidermis covering it be kept in mind, imagining these two layers of tissue to be pliable, a sac made by pressing upon them from without inwards and downwards



Insertion of Three Arrectores Pilorum Muscles in a Hair-Follicle. Transverse section. (Koelliker.)



Transverse Section through the Scalp. Treated with acetic acid.—*a*, interlacing connective-tissue bundles; *b*, groups of hair-follicles. (Koelliker.)



Hair-Follicle in Longitudinal Section.—*a*, mouth of the hair-follicle; *b*, its neck; *c*, bulbous enlargement; *d*, *e*, dermic coat (outer and inner layers); *f*, *g*, epidermic coat (outer and inner root-sheaths); *h*, fibrous substance of the hair; *k*, medulla; *l*, hair-bulb; *m*, fat in the subcutaneous tissue; *n*, arrector pili; *o*, papilla of the cutis; *p*, papilla of the hair-bulb; *s*, mucous layer of the epidermis; *ep*, horny layer; *t*, sebaceous gland. (Biesiadecki.)

would produce the hair-follicle. The innermost layers would represent the epidermis, and the outermost layer the derma.[1]

The hair-follicle may be best comprehended in its relation to the integument, and, in particular, to the hair, by considering the principal parts, or coats, of which it is composed, in the following manner: It is made up of (1) an OUTER, or DERMIC COAT, consisting of a continuation of the general surface of the derma downwards; and (2) an INNER, or EPIDERMIC COAT, which is a continuation of the stratum mucosum of the general epidermis downwards.[2] The dermic coat consists of three layers, and the epidermic coat of two layers.

The dermic coat is the outer, fibrous, and vascular coat, constituting the main part of the hair-follicle in a narrower sense. The epidermic coat is the inner and the epithelial coat, and covers the fibrous or dermic coat; it constitutes the epidermis of the hair-follicle.

DERMIC COAT.

The dermic coat consists of three layers, designated the external, the middle, and the internal. The EXTERNAL, fibrous layer, which gives form to the follicle and belongs to the corium, is made up of connective tissue arranged in longitudinal bundles, together with elastic fibres, occasional fat-cells, some medullated nerve-fibres, blood-vessels, and a net-work of capillaries. The MIDDLE LAYER (the "annular fibrous coat" of Koelliker) is generally thicker than the external layer, and extends from the base of the follicle to the point where the sebaceous glands empty into the follicle. In structure it is made up of an indistinct fibrous basis with numerous layers of connective-tissue corpuscles, with distinct ovoidal or rod-shaped nuclei, running transversely, unaccompanied by elastic-tissue fibres. On account of its resemblance to muscular tissue, this layer has been regarded by some observers (Klein, Heitzmann, Bonnet) as muscular; but Koelliker and Unna both express themselves as opposed to this view. Capillaries, running for the most part transversely, exist here, but nerves have not been demonstrated. This layer is the foundation of the hair-follicle, and continues alone into the papilla.

The INTERNAL LAYER, "hyaline," or "vitreous" membrane (*Glashaut*, Koelliker), is a clear, homogeneous structure, highly developed only in the lower third of the follicle. Although homogeneous on section, according to Biesiadecki, it shows, when viewed on the flat surface, transverse, oblique, decussating fibres with ill-defined nuclei. It is thin in the upper portion of the follicle, and arrives at its greatest thickness at the bulbous extremity, again becoming thinner as it approaches the papilla, where it exists merely as a very delicate membrane. Upon tearing out the hair it always remains in the follicle. It is a variable structure in the degree of its development. Unna is disposed to regard it as a condensation of the middle fibrous layer inwardly, and not as an independent membrane.

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[1] See C. Heitzmann, Chicago Med. Jour. and Exam., Dec. 1881.

[2] This division, which seems to the author to be the simplest and most satisfactory, is adopted in Quain's Elements of Anatomy, 10th ed. London, 1891, vol. i. Part ii.

EPIDERMIC COAT.

The EPIDERMIS OF THE HAIR-FOLLICLE (the "outer root-sheath" of most authors) is the prolongation of the mucous layer of the epidermis, and covers the whole follicle. In order to simplify the complexity of the subject of the sheaths of the hair-follicle, Unna has proposed to abandon the name "external root-sheath" and to designate the same the "prickle-cell layer of the hair-follicle." According to this nomenclature, the "internal root-sheath" of older authors becomes the root-sheath proper.[1] The epidermis of the hair-follicle in structure corresponds entirely to the mucous layer of the general epidermis. It consists, however, of different expressions in the several regions of the follicle. In the funnel-shaped aperture, or mouth of the follicle, it is accompanied as far as the openings of the sebaceous glands by the granular and horny layers of the epidermis, at which point these two layers stop. The mucous layer, contiguous to the vitreous membrane, continues on down alone to the level of the hair-papilla, at which point it abruptly becomes narrower and then tapers off, ending at the neck of the hair-papilla often in a single row of cells. At the base of the hair-follicle it runs without line of demarcation into the cells of the hair-papilla which covers it. The mucous layer of the hair-follicle is about from three to five times thicker than the root-sheath proper of the hair, and attains its greatest thickness at about the middle of the follicle. The corneous layer of the epidermis of the hair-follicle is in the beginning thinner than the mucous layer, but becomes thicker as the mouth of the follicle is approached, and surpasses the mucous layer at last considerably. As Koelliker remarks, how far it goes into the hair-follicle it is difficult to say.

ROOT-SHEATH PROPER OF THE HAIR.

The ROOT-SHEATH PROPER OF THE HAIR, so called by Unna and Koelliker (the "inner root-sheath" of most authors), is a glass-clear, translucent, thin but rigid membrane, extending from just below the line of the opening of the sebaceous glands into the follicle to the hair-bulb. On its outer surface it borders on the epidermis of the hair-follicle, to which it is closely bound and united, and on the other side the connection with the hair is even more intimate. It is to be regarded as a part of the hair.

It is composed of two principal layers, the OUTER, or ROOT-SHEATH in the narrower sense, and the CUTICLE OF THE ROOT-SHEATH PROPER. The root-sheath in the narrower sense shows two or three layers of polygonal, elongated, translucent or light-yellowish cells, which all run parallel with the hair. The outermost layer (the so-called HENLE'S LAYER) consists of elongated, non-nucleated cells closely bound together,

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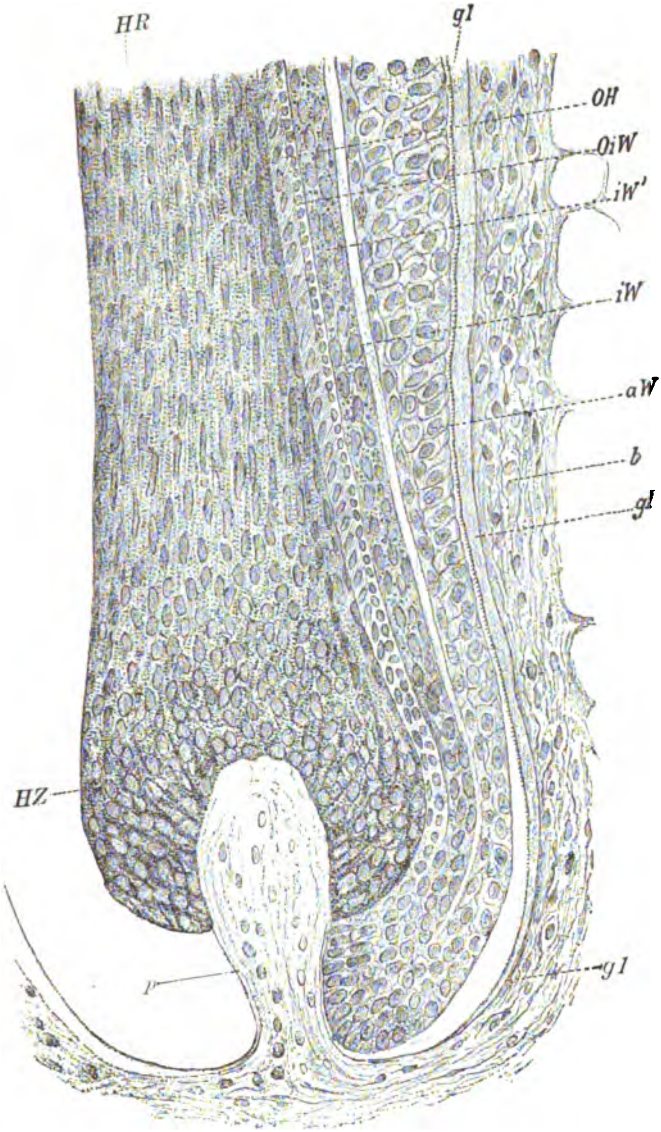
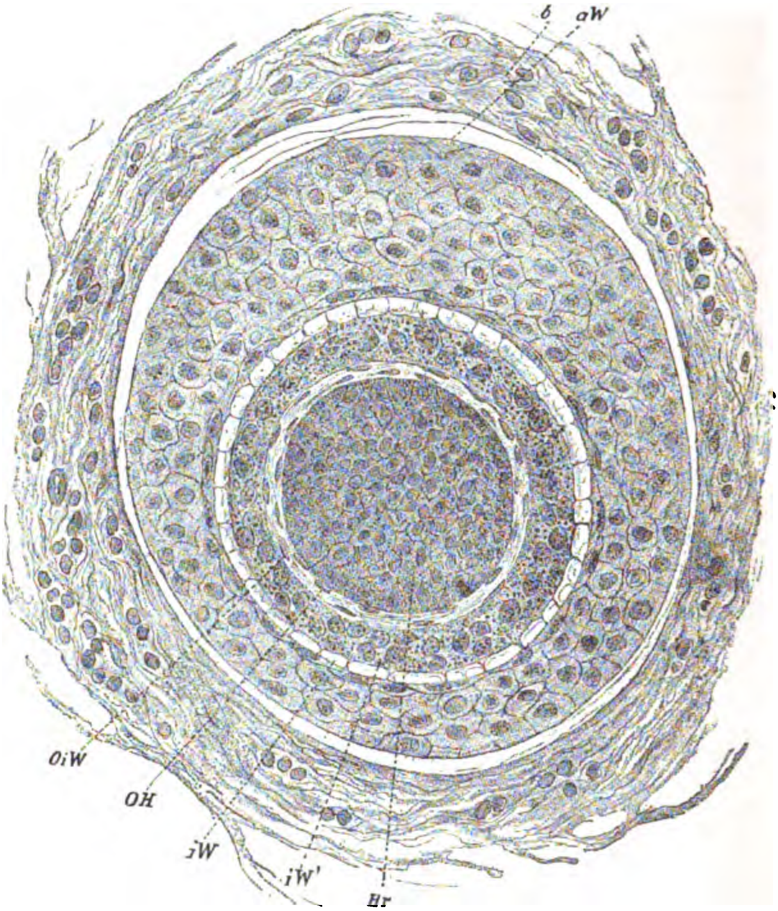
[1] The terms "sheath of Henle" and "sheath of Huxley" Unna regards as superfluous.



LONGITUDINAL SECTION OF A HAIR-FOLLICLE AND A HAIR-ROOT.—*b*, hair-follicle; *gl*, vitreous membrane (internal layer) of the same, with dentations on the inner surface; *a W*, epidermis of the hair-follicle (outer root-sheath); *i W*, root-sheath of the hair (inner root-sheath), outer layer (Henle's layer); *i W′*, inner layer of the same (Huxley's layer), with eleidin-granules; *Oi W*, cuticle of the root-sheath; *OH*, cuticle of the hair; *p*, papilla of the hair; *HZ*, hair-root, with pigment; *HR*, cortical substance of the hair. (KOELLIKER.)



TRANSVERSE SECTION OF A HAIR-FOLLICLE AND A HAIR-ROOT.—*b*, hair-follicle; clear layer between *b* and *a W* vitreous membrane (internal layer); *a W*, epidermis of the hair-follicle (outer root-sheath); *i W*, root-sheath of the hair (inner root-sheath), outer layer (Henle's layer); *i W′*, inner layer of the same (Huxley's layer) with eleidin-granules; *Oi W*, cuticle of the root-sheath; *OH*, cuticle of the hair; *Hr*, cortical substance of the hair. (KOELLIKER.)

but which under the influence of acetic acid and alkalies and by dissection show variously sized clefts or openings between the cells, giving a fenestrated appearance to the structure, which Koelliker believes to be artificially produced. Contiguous with and upon the inner surface of the above coat is encountered another layer (known as HUXLEY'S LAYER), made up of shorter and broader polygonal nucleated cells. These two elements of the root-sheath separate in alkalies, but do not swell up, and undergo but little change in caustics, peculiarities which they share with the lamellæ of the cuticle of the root-sheath proper and of the hair. At the base of the hair-follicle both layers of the root-sheath proper pass into soft, still elongated but broader, polygonal cells with peculiar granular contents, which, becoming more rounded, extend to the deepest parts of the hair-papilla and there blend with the contiguous layers of the hair. The "granular contents" referred to, noted first by V. von Ebner,[1] are eleidin, as described by Ranvier. In the more elongated cells they are large, mostly rod-shaped, but also rounded, and in the rounded-angular cells, smaller, and seated in a more rounded and annular form about the nucleus.

On the upper portion of the hair-follicle the root-sheath proper not infrequently stands off from the hair, terminating close to the point of opening of the sebaceous gland with a sharply notched edge. Ebner and Koelliker both found here some loose cells of the root-sheath proper, from which it may be concluded that this structure, which continues to grow with the hair, exfoliates, its elements commingling with the sebaceous matter. Above the sebaceous glands the epidermis of the follicle takes the place of the root-sheath proper, the more superficial strata of which possess all the properties of the horny layer.

CUTICLE OF THE ROOT-SHEATH.

The CUTICLE OF THE ROOT-SHEATH PROPER is closely adherent to the latter structure, and much resembles the cuticle of the hair, with which it comes in close contact. It is demonstrated best with alkalies, and, together with the root-sheath proper itself, may be separated from the hair, the cuticle of the hair, on the other hand, remaining fixed to that structure. The membrane is made up of non-nucleated, shingle-like, broad cells, which are thicker than those of the cuticle of the hair. As Ebner has shown, the arrangement of the individual cells of the cuticle of the root-sheath proper *in situ* is downwards, while that of the cuticle of the hair with its free edges is upwards, so that the scales of these two contiguous layers are placed in opposite directions and fit into the serrations of each other. In the extraction of a hair, therefore, the resistance thereby caused must be overcome, the root-sheath proper often coming away attached to the hair.

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[1] Mikr. Studien über Wachsthum und Wechsel der Haare, 56 pp., 8 pl. Wien, 1876. Reprinted from Sitzungsb. d. k. Akad. d. Wissensch., Math.-naturw. Cl., Bd. lxxiv. Wien, 1876.

The stratum corneum of the epidermis of the general surface of the integument, turning in and downwards, produces the root-sheath proper, while the stratum mucosum forms the epidermis of the hair-follicle (the "outer root-sheath" of most authors).

HAIR-PAPILLA.

At the base of the follicle rises the HAIR-PAPILLA (*papilla pili*), an ovoidal, club-shaped or spherical, well-defined structure (from 110 to 300 $\mu\mu$ long, and from 50 to 220 $\mu\mu$ broad, Koelliker), connected by a pedicle with the connective tissue of the corium, of which it is a projection upwards. It is composed of connective tissue, devoid of fibrillæ and elastic fibres, and contains numerous colorless or pigmented connective-tissue corpuscles. Blood-vessels occur within the structure, and nerves have been described here; but Koelliker is of opinion that nothing is definitely known about the latter. In other localities, however, especially in connection with the follicle and its membranes, nerves and nerve-endings are found in abundance, as the observations of Merkel, Ranvier, and Bonnet have shown.[1] The hair-papilla has its analogue in the papilla of the corium.

THE HAIR.

EARLY DEVELOPMENT OF THE HAIR.

The rudiments of the hair, according to Unna, first appear on the face at about the end of the third month, on the backs of the hands in the seventh month, and about a month later on all parts of the body. According to Koelliker, the hair-rudiments consist of club-shaped epithelial growths of the mucous layer pressing into the corium, covered with the horny layer. The follicle takes on shape, and the cells in the interior resolve into the conical hair and into the root-sheath. The hair-rudiment lengthens and becomes the "primitive hair-cone," swells out at the bottom of the future follicle, and is fitted to the papilla, which has now arisen from the corium. The young hair continues to grow, and at about the end of the fifth month penetrates the horny layer, having, as Eschricht[2] has shown, a very regular arrangement, converging and diverging in certain directions to form curves and "whorls." The embryonal hair (*lanugo*) is devoid of medullary substance.

In the beginning of the seventh month the bed-hairs leave the papillæ, their ends having a bulbous form, and ascend to the middle of the follicle, which is here swollen, and where they are arrested, continuing to grow by accretions received from the epithelium of this region (Unna). The lower portion of the follicle instead of collapsing becomes possessed of a more translucent epithelium, which remains a long time, disappears, with shortening of the follicle and with atrophy of the papilla, and is again replaced.

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[1] See Koelliker, loc. cit., p. 239.

[2] Ueber die Richtung der Haare am menschlichen Körper, Müller's Archiv, 1837, p. 37.

In the eighth month the loosening of the primary hairs takes place on the scalp, and later upon the trunk and other regions. This hair-change persists after birth, and occurs over the whole body. As Unna says, when a child has a very thick, long, erect, and often dark head of hair at birth, the normal hair-change on the fœtal head has been postponed until after birth. This growth of hair is made up of old primary hairs detached from the papillæ, seated in shortened follicles, which have sent downwards from their sides productive epithelial processes. "They are not ordinary papillary hairs, but 'bed-hairs,' which have been growing for two months out of the epithelium of the middle follicular region, the 'hair-bed.' Near the end of intra-uterine life the epithelial processes produce new young papillary hairs in their interior after the exact pattern of the primary hair-rudiments, and these, usually before birth, but often after it, supplant the bed-hairs by loosening them from below, growing out of the follicle beside them, and finally causing them to fall out." The hair-change of the new-born is, therefore, an interchange between two distinct types of hair.

At birth, normally, a relative degree of absence of hair exists over the whole body, but the hair of the scalp at once begins to develop, and later like activity follows in other regions. The formation of new hairs is preceded or accompanied by a shedding of the old hairs, a process which continues in a somewhat variable manner throughout life. Sometimes this shedding of the hair under apparently normal circumstances is periodical, as in the case of Leeuwenhoek,[1] who in his own person, with the exception of the scalp and beard, lost his thick hairy coat from the general surface every spring, the crop being replaced in a remarkably short time. As was first suggested by Biesiadecki, the smooth muscles of the hair-follicles play a part in the shedding of the hair, their contraction causing a neck to be formed around the young hair.

As C. Heitzmann has stated, the new growth of a hair takes place within the province of the root-sheath proper exclusively. The hair is a production of the root-sheath proper. It is a solid elongation springing from this stratum. The epidermis of the hair-follicle (the "outer root-sheath" of most authors) is not concerned in its production. The young hair is formed around the old papilla, as has been shown by Koelliker and C. Langer.

HAIRS.

GENERAL OBSERVATIONS.

Hairs are found occupying the greater part of the body, showing differences in size, number, and distribution, depending upon the sex, race, age, region, and peculiarities of the individual. They are long, rounded, compact bodies, having their seat in depressions in the skin, designated hair-follicles. They occur upon all parts of the body except upon the palms, soles, eyelids, dorsal aspect of the last phalanges of the fingers and toes, lips, and inner surface of the prepuce and glans penis. The number of hairs, even upon the same region, varies with individuals, depending upon different causes, as, for example, color. Upon scalps containing the average covering of hair it is found that those with light-colored hair yield the largest number of individual hairs. A German observer has counted the hairs upon four different heads, representing red, black, brown, and light hair, and found that in the red crop there were 90,000 hairs, in the black 108,000, in the brown 109,000, and in the light 140,000.[1] Erasmus Wilson[2] calculates the average number of hairs of the scalp to be about 1000 to the square inch, or (allowing an estimate of 120 square inches for the scalp) 120,000 to the whole scalp. Other calculators estimate the number to be less.

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[1] Quoted from Koelliker, op. cit., S. 244.

VARIETIES OF HAIR.

There are many kinds of human hair, as represented by the various races of man. The variations are numerous, depending mainly upon the degree of straightness or curl, calibre, length, and color. Hair has been elaborately classified from an ethnological stand-point by P. A. Browne.[3] Charles Stewart,[4] of Edinburgh, in 1873, in comparing the scalp of the negro with that of the European, found that the portion of the hair and follicle embedded in the skin is much longer, and is also remarkably curved. This observation has been verified by T. P. Anderson Stuart,[5] who finds that the curve is about a quarter of a circle, and is of opinion that this curve of the hair within the follicle accounts for the curl of the hair outside of the follicle.

Three forms of hair are recognized. (1) **LONG HAIR**, comprising soft hairs from two inches to three feet (5 cm. to 1 metre) and more in length, and from 0.02''' to 0.05''' (50 to 110 μμ) in thickness, as on the scalp, beard, chest, armpits, and genital region. (2) **BRISTLE-HAIR**, short, stiff, and thicker hairs, from one-quarter to one-half inch (0.6 to 1.3 cm.) in length, and from 0.03''' to 0.07''' (50 to 120 μμ) thick, as on the eyebrows, borders of the eyelids (eyelashes, or *cilia*), nares (*vibrissæ*), and external auditory canal. (3) **FLEECY HAIR** (*Wollhaar*), **DOWNY HAIR**, or **LANUGO**, very short, extremely fine, soft hairs, from 1''' to 6''' (2 to 14 mm.) in length, and from 0.006''' to 0.01''' (13 to 22 μμ) in thickness, as on the face, buttocks, extremities, caruncula lachrymalis, and labia minora.

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[1] Med. Record, March 12, 1887.

[2] Lectures on Dermatology, London, 1878, p. 99.

[3] The Classification of Mankind by the Hair and Wool of their Heads, with the Nomenclature of Human Hybrids. Philadelphia, 1852.

A collection of hair from all races is preserved in the Mütter Museum of the College of Physicians of Philadelphia.

[4] Quoted from Jour. of Anat. and Phys., 1882, vol. xvi. p. 362.

[5] Jour. of Anat. and Phys., 1882, vol. xvi. p. 362.

IMPLANTATION OF THE HAIR.

As a rule, there is only one hair in each follicle, but sometimes there are two or even three. The hairs stand either singly or in groups of two, three, or even five. Upon the scalp they are generally arranged in groups. They are usually implanted obliquely in the skin, their direction depending upon that of the hair-root. Their arrangement is under the same laws that govern the cleavage of the skin and the papillary formation of the corium, as has been shown by Blaschko.[1] The direction of the hairs for the different regions was first elaborated by Eschricht[2] and later by Voigt.[3] They follow in their course of distribution peculiar lines and curves, which in certain localities, as the crown of the head, form segments of circles and circles, or "whorls." The explanation of this arrangement is found in the direction of the bundles of connective tissue of the corium, as has been described by C. Langer and Tomsa.[4]

COLOR OF THE HAIR.

The color of the hair varies with the race and with the individual, depending upon three factors,—namely, (1) pigment granules, (2) soluble coloring matter affecting the hair-fibres, and (3) the presence of air. The first, or granular pigment, occurs in all shades from light yellow to red and from brown to black, and is found surrounding the individual cells of the cortex of the hair. The general coloring matter imparts, according to its intensity, a brownish or a dark red color to the hair. This unites with the pigment granules, one or the other usually predominating, and produces various shades. The soluble coloring matter is entirely wanting in white hairs, is sparse in light blonds, and is most abundant in those of dark brown hair. The coloring of the external layers of the cortex usually denotes the shade of the hair, for, as Pincus[5] has shown, owing to the presence of air in the cortex the hair may take on a whitish color in spite of the fact that the central portion is dark. Absence of the general coloring matter and of pigment granules renders the hair gray and transparent, and if the presence of air is superadded the hair becomes white and opaque, as in old age. Black is the almost universal color of the hair, the races with blond hair, as the Germans, Celts, and Finns, being in the minority. Red hair occurs only among individuals, and is met with exceptionally in all races.

In considering the hair two portions are distinguished, the SHAFT (or *scapus*), which is free and protrudes beyond the surface of the skin, and the ROOT (or *radix*), the portion contained within the skin and seated in the hair-follicle. The shaft in uncurled hairs is usually long and straight, rounded or somewhat flattened, and tapers off at its free extremity to a point. In crisp and woolly hairs it is flattened or ribbed and curled. The straightest hair is found in the American Indians, Chinese, Japanese, Polynesians, and Malays, and the curliest in the negroes.

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[1] Beiträge zur Anat. der Oberhaut, Archiv für Mikr. Anat., Bd. xxx. (1887).

[2] Müller's Archiv, 1837, S. 37.

[3] Abhandlung über die Richtung der Haare am menschlichen Körper, Denkschriften der mathem.-naturw. Cl. der Wiener Akad. d. Wissensch., Bd. xiii. Wien, 1857, S. 3.

[4] Archiv für Derm. u. Syph., 1873, i.

[5] Quoted by Unna, loc. cit.

The root terminates in a somewhat curved, bulb-shaped expansion, called the HAIR-BULB (*bulbus pili*), seated upon the HAIR-PAPILLA (*papilla pili*). The hair within the follicle is surrounded by the ROOT-SHEATH PROPER,—a clear, thin layer which extends from the hair-bulb to the duct of the sebaceous glands. The hair consists of the cortical substance, the cuticle, and the medulla of the hair, which latter, however, is not constantly present.

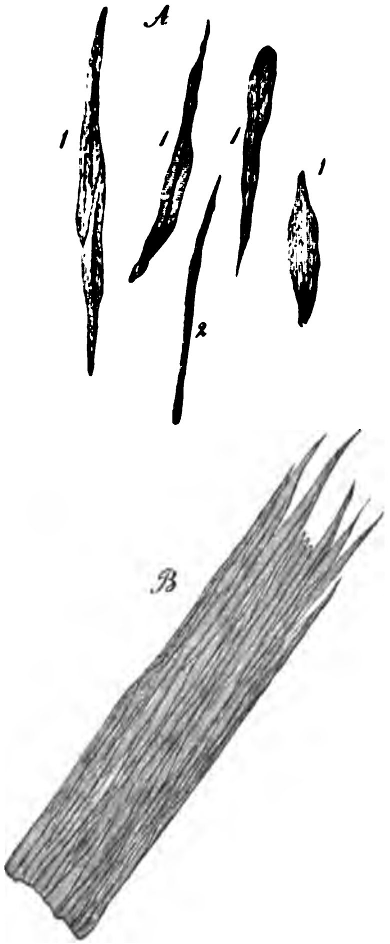
CORTICAL SUBSTANCE.

The CORTICAL SUBSTANCE, HAIR-SUBSTANCE, or FIBRE-TISSUE (*substantia fibrosa seu corticalis, cortex*), constitutes the bulk of the hair, and is composed of elongated, narrow, spindle-shaped bundles of fibres, longitudinally striated, usually colored more or less uniformly, and often containing pigment granules, which give it a punctate, spotted, or streaked appearance. The bundles, made up of light- or dark-colored, long, flat fibres of varied width, are further remarkable in being stiff and brittle, and in having irregular ragged borders and ends. They are closely bound together, and are seen to best advantage after separation by treatment with sulphuric acid.

These bundles are composed of numerous still smaller plates or cells, the LAMELLÆ OF THE FIBROUS SUBSTANCE (or FIBRE-CELLS OF THE CORTEX), which are the ultimate elements of the hair. They are flat and in general spindle-shaped, with uneven surfaces and irregular borders. They do not swell in caustic alkalies, and show within very often a darker streak, and sometimes pigment granules (Koelliker).

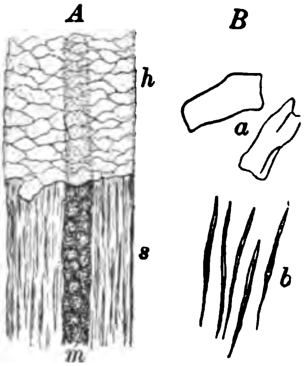
The dark points and spots and streaks of the cortical substance consist for the most part of granular pigment, of air or fluid filling up the space cavities, and of nuclei. The spots due to the presence of air are more commonly observed in white and light hairs. Moderately dark small streaks or lines—the borders of individual cells or the nuclei of these cells—are also met with. Koelliker describes, in addition, fine streaks having their seat in the cortical substance, particularly plain in a white portion immediately above the bulb, that are produced by unevenness of the surface of the lamellæ of the cortex.

In the hair-root, the structures are the same as described for the shaft until the softer and finer-fibred lower half is reached. The fibre-like structure here by degrees disappears, and the lamellæ now become gradually changed into softer, elongated, nucleated cells (easily separable with acetic acid), further down passing into elongate-rounded or rounded cells,



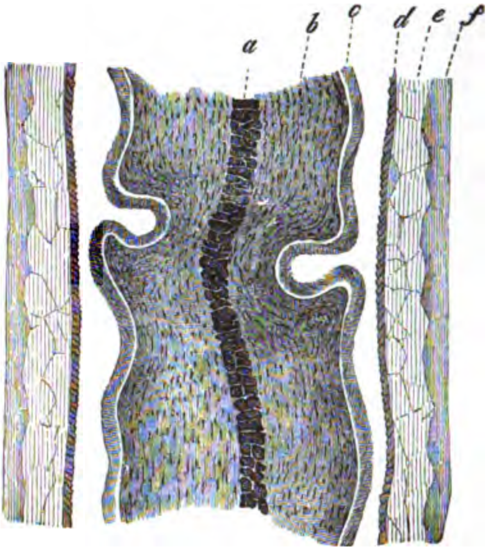
Plates, or Fibre-Cells, of the Cortical Substance of the Hair, from a hair treated with sulphuric acid.

A, isolated plates; 1, broad surface view (three single and two bound together); 2, view of side. *B*, one composed of numerous such plates or fibre-cells. (Koelliker.)

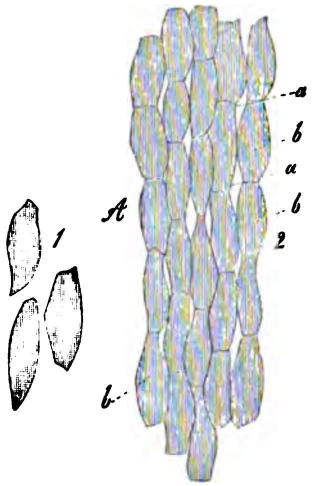


A, **Human Hair.**—The upper half shows the superficial corneous cells (*h*) constituting the cuticle, the lower half (*s*) the cortical substance and the medulla. *B*, isolated fibres of the hair: *a*, cuticular scales; *b*, fibre-cells of cortical substance. (Piersol.)

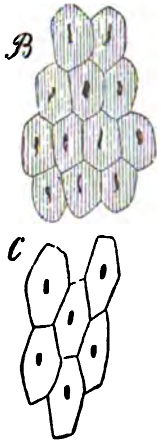
Two Cells of the Cortical Substance of the Hair-Root (finely striated portions of the same from close over the hair-bulb), with clear nuclei and striped appearance. 350 diam. (Koelliker.)



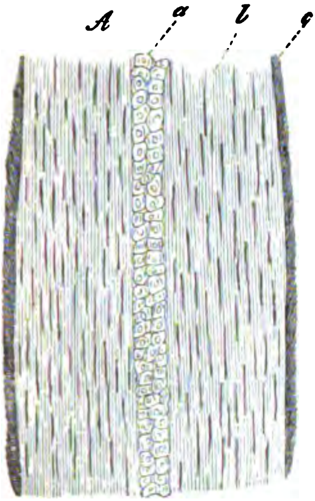
A Portion of the Root of a Dark Hair, lightly treated with Soda.—*a*, medulla still containing air and with tolerably plainly marked cells; *b*, cortical substance with pigment spots; *c*, inner layer of the cuticle; *d*, outer layer of the same; *e*, inner layer of the root-sheath of the hair (Huxley's layer); *f*, outer fenestrated portion of the same (Henle's layer). 250 diam. (Koelliker.)



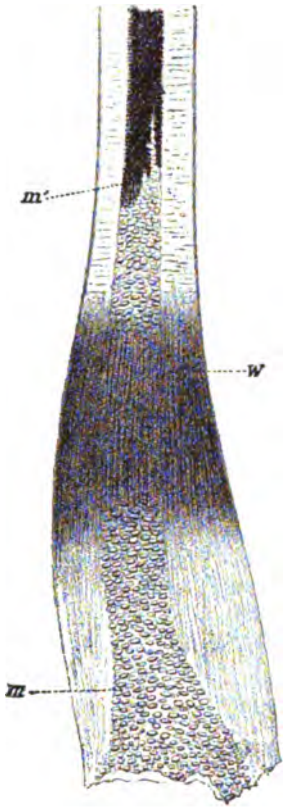
Elements of the Inner Root-Sheath.—*A*, from the outer layer; *1*, isolated lamellæ of the same; *2*, the same in coherence, from the upper parts of the layer in question, after treatment with soda; *a*, openings between the cells *b*.



Elements of the Inner Root-Sheath.—*B*, cells of the inner non-perforated layer with elongated and slightly dentated nuclei. *C*, nucleated cells of the single-layered, deepest parts of Huxley's layer. (Koelliker.)

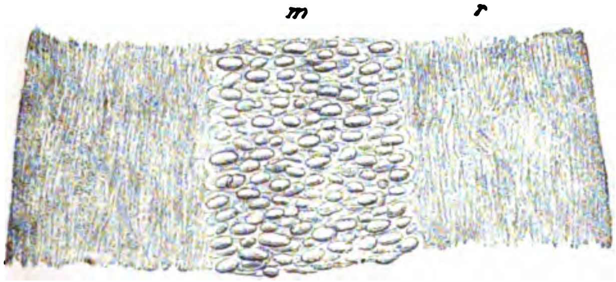


A, **Portion of a White Hair after Treatment with Soda.**—*a*, cells of the medulla containing nuclei without the presence of air; *b*, cortical substance with fine fibres and distinct linear nuclei; *c*, cuticle with the lamellæ standing off the hair more markedly than usual. 350 diam. (Koelliker.)



Root of a White Hair.—*m*, medulla with eleidin-granules; *m'*, medulla with air; *W*, white places in the cortical substance of the hair-root. (Koelliker.)

B, **Three Single Linear Nuclei from the Cortical Substance.** (Koelliker.)



Eleidin-Granules in the Medulla *m* **of root of a White Hair**; *r*, cortical substance. (Koelliker.)

with short nuclei, closely pressed together, which continue down to the papilla. They resemble the cells of the mucous layer of the epidermis, and contain either colorless granules or so many dark pigment granules as to be true pigment-cells. In addition to these pigmented cells, the hair-bulb in its deepest portion contains a variable number of stellate pigment-cells, which Koelliker regards as connective-tissue cells that have wandered in from the hair-papilla. This observation, made also by Aeby[1] and Riehl,[2] is important, and aids in explaining the function of pigment-formation.

MEDULLA.

The MEDULLA, MEDULLARY SUBSTANCE, or PITH (*substantia medullaris*), occurs in the median line of the hair, extending from the bulb to near the free end of the hair in the form of a cord-like structure. It is usually present in thick, short, and strong hairs, but is often absent in lanugo and in colored hair of the scalp. After treating the hair with caustic soda the medullary cells are seen to be rectangular, quadrilateral, rounded, or spindle-shaped, with here and there dark granules like fat, and with a rounded, bright spot, probably representing the cell-nucleus. In fresh hairs the medulla in the shaft is silvery-white by light from above, and by light from below black, which appearance is produced by great numbers of rounded or angular so-called "granules" occupying the medulla cells. These "granules" have been proved by experiment to be air-vesicles, and not fat or pigment as was formerly supposed. In the bulb the medulla contains no air-vesicles, but over the entire width its cells possess peculiar contents, consisting of shining round or ovoidal structures, like the eleidin of the epidermis. They were first accurately described by Waldeyer,[3] and subsequently by Ranvier.[4] The diameter of the medulla corresponds generally to that of the hair itself as 1 : 3–5, and is thickest in short thick hairs and thinnest in lanugo and scalp hairs. Koelliker[5] records having met with a double medullary cord in the hair of the upper lip, and with four medullary cords in the hair of a reddish beard.

CUTICLE OF THE HAIR.

The CUTICLE OF THE HAIR is a notably thin, transparent membrane, which is a complete covering for the whole hair and binds its bundles together. It is made up of flat, transparent, quadrilateral or rectangular, non-nucleated lamellæ, which on the hair overlap one another, as shingles upon a roof, the lower overlapping the upper cells. The arrangement of these cells upon the hair gives it a reticulated or serrated appearance, like the scales upon a fish. Treated with alkalies they become detached from the hair and separate into their elements.

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[1] Med. Centralbl., 1885, Nr. 16.

[2] Viertelj. f. Derm. u. Syph., 1884, p. 33.

[3] Op. cit. [4] Op. cit. [5] Op. cit., S. 228.

NAIL.

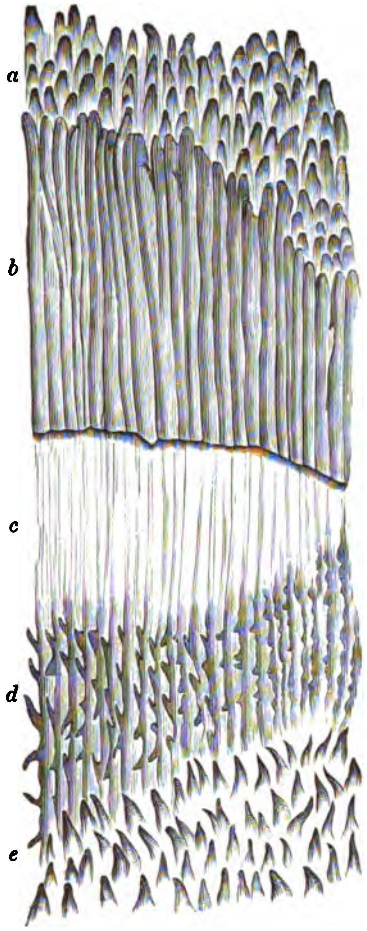
The NAILS (*ungues*) are hard, horny, elastic, transparent structures which are embedded in the corium upon the last phalanges of the fingers and toes. They are rounded or quadrilateral plates, and are curved postero-anteriorly and from side to side. They possess four edges, only one of which, the anterior, is free, the posterior and lateral edges being sunk in the skin. The uncovered part of the nail is termed the BODY, terminating anteriorly by a free edge; and the posterior portion, embedded in and concealed by the groove, is termed the ROOT. Around the lateral and posterior edges of the nail, at the line where the true skin joins the nail, there exists a well-defined groove, designated the NAIL-GROOVE. That portion of the skin which arises from the groove, and which covers in the nail as a fold, is known as the NAIL-FOLD, or NAIL-WALL. The EPONYCHIUM, or NAIL-SKIN, is a thin layer of cuticle which proceeds from the nail-fold and, extending forward, covers as a film the beginning of the body of the nail to a variable, but usually very short, distance. The epidermis of the skin upon which the under surface of the body of the nail rests is designated the HYPONYCHIUM, and the epidermis bordering the entire nail the PERIONYCHIUM. Upon the outer surface of the nail, which is smooth and glistening, there exist more or less marked striæ or minute ridges running parallel with the long axis of the nail.

The LUNULA (or SEMILUNULA) is the little whitish, half-moon-shaped or crescentic spot which exists in front of the nail-fold and extends on either side to the lateral edges of the nail. It is most distinctly defined on the thumb, and is often not defined or is wanting on the toes. The color of the nail when seated in its natural place is, on the free border grayish or yellowish, and translucent, on the body reddish, and on the lunula whitish, the two latter colors being due to the vascularity of the corium beneath showing through.

The nail is a peculiar metamorphosed portion of the epidermis, and is made up of two layers in the same manner as is the epidermis of the skin, a soft, mucous layer and a hard, horny layer, the latter composing the NAIL PROPER. It begins with a narrowed extremity at the bottom of the nail-fold, becoming thicker and attaining its definite thickness after leaving this covering, which it usually retains over the entire nail-bed, except towards the lateral borders and the free edge, which are thinned.

NAIL-BED.

The NAIL-BED is that portion of the corium anterior to the matrix upon which the nail-substance rests, and corresponds in form to the nail. It is divided into two parts: (1) a posterior (*matrix unguis*), embracing the root of the nail; and (2) an anterior part, the bed of the nail proper. It possesses an elongated, quadrilateral form, and presents a convex surface from the free edge to the root, and, more markedly so, from side to side. It presents upon its surface peculiar ridges (LAMINÆ, or



Floor of the Nail, lengthwise view (from *a* to *e*), divided in half in the median line.—*c*, *d*, *e*, matrix of the nail, *e* being the posterior portion with smaller pointed papillæ, *d* the middle portion, showing ridges with papillary elevations, *c* the field of the lunula, with feebly expressed ridges, defined by a sharp line from the nail-bed towards the anterior portion; *b*, nail-bed, with smooth elongated ridges terminating forward in club-shaped enlargements; *a*, papillæ of the tip of the finger. (H. Hebra.)

LAMELLÆ), with papillæ on their summits, similar to, but smaller than, those upon the palms and soles, which begin at the bottom of the nail-groove at the posterior edge of the nail-bed, and from a middle point proceed obliquely outward, being better marked towards the distal end. Those in the median line are straight, while those on either side pursue a curved outward and forward course.

The nail-bed consists of subcutaneous connective tissue, corium, and mucous layer of the epidermis. The subcutaneous connective tissue is mainly or entirely without fat, and is further characterized by the course of the ascending connective-tissue fibres, which arise as separate fasciculi from the periosteum of the last phalanges, expand in a brush-like manner, and are directed both upwards and backwards towards the root of the nail. This arrangement is the RETINACULA UNGUIUM of Koelliker.

Unna[1] finds the papillary layer of the corium over the whole substratum of the nail exactly as described by H. Hebra.[2] Beginning from behind occurs a semicircle composed of several (three to six) rows of very slender papillæ. Next to this comes a lenticular space, enclosed behind and before by slightly curved lines, the anterior border of which corresponds exactly to the anterior edge of the lunula. This space contains comb-like ridges bearing papillæ, which steadily decrease in size anteriorly, and entirely disappear near the lunula. These ridges do not all run parallel from behind forward, but converge symmetrically in their posterior division to a curved border of the nail-fold, those situated externally adapting themselves to the curved border of the nail-fold. These two divisions together correspond to the matrix, from which statement it will be seen that the matrix is by no means homogeneous, having posteriorly a papillary and anteriorly a simple bed-like character (Unna).

MATRIX.

The MATRIX, or germ-layer, of the nail corresponds to the mucous layer of the epidermis, and is composed of the same cellular elements, with essentially the same structure, as that membrane. It occupies the posterior portion of the nail-bed, lying partly or wholly within the nail-fold, and is the exclusive seat of the formation of the nail. The nail-bed, other than this portion of it, does not aid in generating the nail. The lunula does not indicate the entire matrix.

The surface of the matrix, which is seated on a somewhat lower plane than the nail-bed, is covered with papillæ directed forward (as Henle pointed out) and implanted on low ridge-like elevations of the corium. Upon the lunular portion of the matrix the papillæ are much less developed than in the rest of the matrix, and possess no regularity of arrangement.

The ultimate end of the cells of the stratum mucosum varies; on the nail-bed proper the cells abruptly pass into flat epidermal scales, as occurs on the general surface of the skin, but on the matrix they pass gradually into nail-substance. If the nail be divided into two lateral halves by vertical section, it will be seen that the layer of nucleated flattened cells over the matrix of the nail is much thicker than over the nail-bed, and that over the nail-matrix they are continuous, by an oblique furrowed surface, with the nail-substance (Biesiadecki).

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[1] Op. cit., p. 28.

[2] Wiener Med. Jahrb., 1880.

The nail-bed and the matrix are both highly vascular. The blood-vessels in the forward part of the nail-bed are abundant, but are less so about the root of the nail. The capillaries are in the form of loops, which about the larger papillæ are coiled or even knotted, and, being compressed from above, give a peculiar, matted or verrucous appearance to the surface. Nerves and nerve-endings are not so abundantly supplied to this region as to the surrounding skin. According to Biesiadecki,[1] the medullated nerves of the subcutaneous connective tissue lose their medullary sheath at about the level of the corium and run vertically to the surface.

NAIL PROPER.

The horny layer of the nail, or the NAIL PROPER, upon its under surface is entirely even at the root, but farther forward shows well-defined separated ridges which enter the matrix. The intimate structure of the nail-substance is studied by first preparing the specimen in alkalies and acids, in which the cells swell up and by heat may be isolated. The nail is made up of separate strata composed of polygonal, nucleated cells, or little plates, much as in the horny layer of the epidermis, except that the nuclei are more distinct, and are present through nearly all the strata. The latter are easily seen in soda and acetic acid. In the lower strata they are thicker and on the periphery somewhat smaller than in the upper layers. As in the cells of the horny layer of the epidermis, there exist in those of the nail quite distinct remains of prickles, which are visible in the unchanged elements as well as in those which are swollen, which appear as little concavities. A peculiar appearance is the occurrence of air in the nail-substance proper, in the form of larger or smaller vesicles having their seat in the intercellular spaces and also in the interior of the plates. The so-called "white spots" not infrequently observed in nails, as single or multiple lesions, are due to this cause.

The arrangement of the lamellæ of the nail of the superficial layers is horizontal or rising with a slight slope. In the deepest strata there is a disposition for the plates to overlap at their borders. On the free surface of some nails in the ridges, owing to a certain number of lamellæ here pursuing a concentric course, columnar strings are formed, which lead to the long, forwardly inclined papillæ of the farthest end of the nail-bed.

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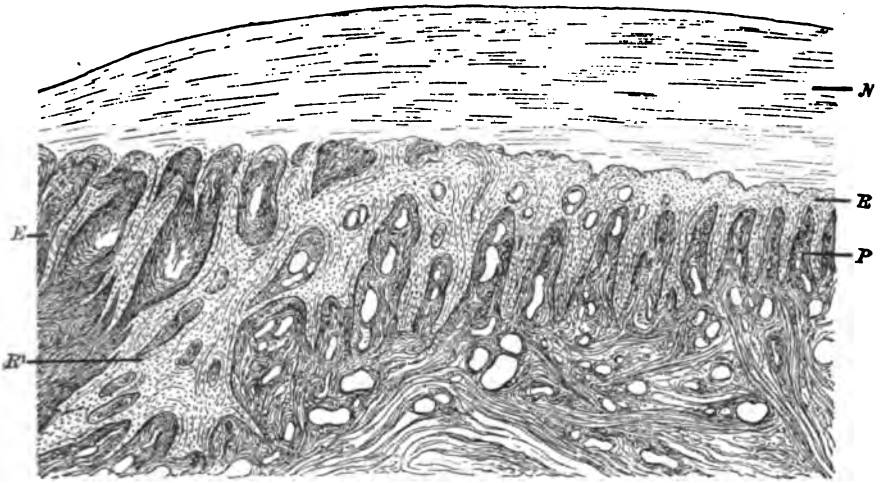
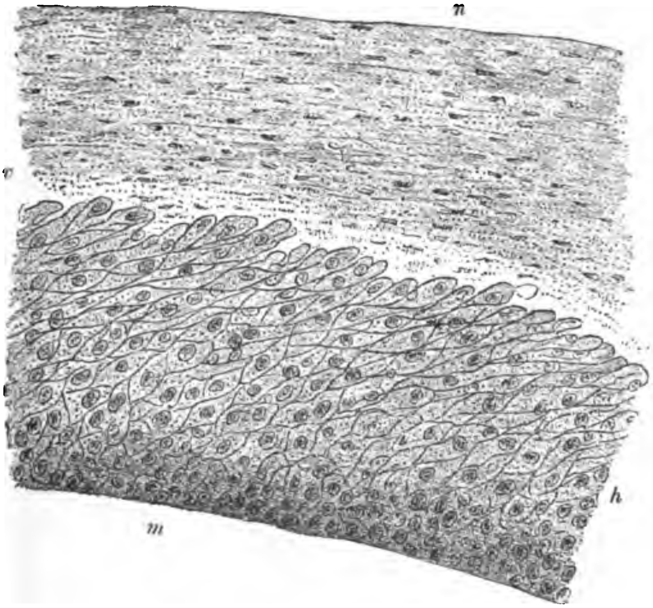
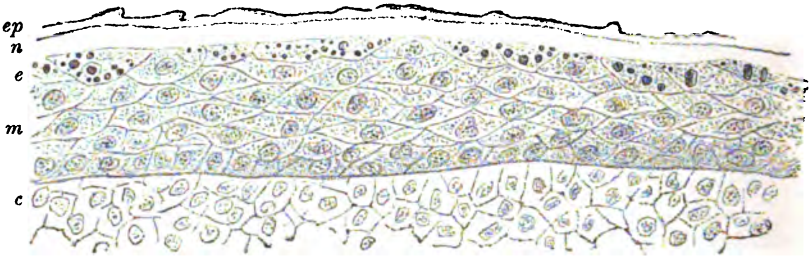
[1] Op. cit., p. 260.



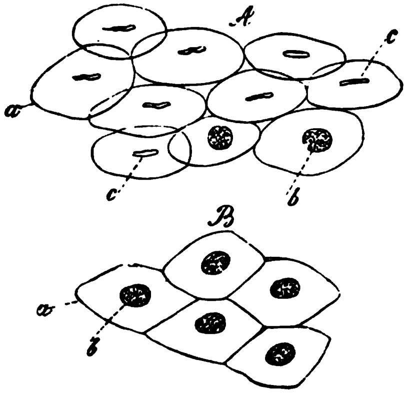
Implantation of the Nail at its Posterior Border.—*P*, papillæ, decreasing in size towards the middle line, R^1; *E*, epidermal layer of medium thickness; *N*, plate of the nail. 50 diam. (C. **Heitzmann**.)



Vertical Longitudinal Section through the Matrix of the Nail *m* and the contiguous portions of the corneous layer of the same *n*; *h*, posterior, *v*, anterior portions. (**Koelliker**.)



SAGITTAL SECTION THROUGH THE DORSAL PORTION OF UNGUAL PHALANX OF A HUMAN FŒTUS FOUR MONTHS OLD, showing, *ep*, eponychium; *n*, nail-lamellæ; *e*, cells with eleidin-like granules in the superficial layers of the mucous layer; *m*, mucous layer; *c*, nail-bed. (KOELLIKER.)



NAIL-LAMELLÆ, COOKED IN SODA.—*A*, side view, *B*, surface view; *a*, investing membranes of the swollen nail-elements; *b*, nuclei of the same, surface view, *c*, side view. 350 diam. (KOELLIKER.)

LUNULA.

The lunula is only in part the macroscopic expression of the matrix of the nail. It does not really end at the edge of the covering of the nail-fold, but extends on either side to the lateral borders of the nail. Frequently it becomes visible only after the nail-fold has been pushed back or removed. The difference in color of the lunula and the nail-bed is due to the fact that the nail-bed is covered by a transparent horny substance, whereas in the former there exist positively opaque elements which dissipate the light. These are the transitional cells, which are thickly covered with points, which by transmitted light appear darker and by reflected light whiter than the granular cells. Their presence marks the exact boundary of the lunula. As Toldt[1] expresses it, the lunula is caused by a decreased transparency of the nail, due to the mucous layer producing here a thick, actively proliferating, broad, uniformly distributed layer, the cells of which are in active process of division.

Hans Hebra's[2] studies show that the lunula corresponds to a portion of the nail-bed which is devoid of papillæ, and that it does not take part in the formation of the nail. The true matrix, he states, lies behind the lunula, and is entirely hidden by the nail-fold. From the nail-root forward to the lunula the nail lies directly on the germ-cells and papillæ. From the anterior edge of the lunula forward the granular layer intervenes between the nail and the mucous layer. The meaning of the lunula is not plain.

At a point just before the anterior free edge of the nail is reached there exists in the nail a narrow YELLOWISH BAND, at which line the red color of the nail-bed abruptly terminates, owing to the presence of opaque granular cells (Unna).

The eponychium is a partially horny tissue under which the fœtal nail develops. It is, as Unna states, homologous with the epitrichium covering the hoof in animals, and, according to Bowen,[3] is a part of the epitrichial layer. The nail, according to the latter observer's studies, is a modified portion of the stratum lucidum, and becomes exposed by the loss of the epitrichial layer. This layer undergoes a keratosis and forms a part of the stratum corneum.

GROWTH OF THE NAIL.

If the nail is left uncut, it grows to a definite length beyond the end of the finger or toe, terminating in a narrowed, bent extremity. The free end wears itself away by natural desquamation of the cells. The extent of growth varies with the sex and the individual, and depends upon its thickness and the cohesion of its cells. Among certain Oriental peoples it is known in some instances to grow to a length of from one and a half to two inches (from three to five centimetres), usually bending or crooking itself upon the fingers. The nails are thickest upon the great toe of elderly men, and thinnest upon the little finger and little toe of women. Koelliker estimates the thickness for the thumb at from 0.50 to 0.60 mm. They grow more rapidly in summer than in winter, and more rapidly in children than in adults. They require for their growth from the lunula to the free edge on the fingers, according to Berthold, from 108 to 161 days; Dufour gives the time at from 121 to 138 days. On the toes the latter observer makes the time from 180 to 300 days, and Hallux 365 days.[1] The average growth is about $\frac{1}{32}$ of an inch a week (Quain). The nail grows by the generation of the cells of the mucous layer at the root. The horny cells are pushed forward by the new mucous cells, cornification taking place as in the horny layer of the epidermis of the skin.

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[1] Quoted from Quain, op. cit., p. 417.

[2] Med. Jahrbücher, Wien, 1880, p. 59.

[3] Anatom. Anzeiger, IV. Jahrgang, 1889.

The nail begins to form in the third month of intra-uterine life. In the fifth month the first trace of the definite nail is noted in the form of a small lenticular collection of prickle-cells at the nail-fold, beneath the eponychium. This membrane yields to the growth of the nail during the next two months, and gradually breaks away, remaining only upon the posterior part of the nail. The remains of this membrane continue throughout life partly covering the lunula. At birth the granular layer has appeared between the prickle-layer and the horny layer (Unna).

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[1] Quoted from Koelliker, op. cit., p. 217.

PHYSIOLOGY OF THE SKIN.

As has been shown in considering the anatomy, the skin is a complex organization. It fulfils not merely the passive office of encasing and protecting the organism, but also certain important functions. In structure it is composed of many parts, closely knitted together so as to form a compact covering. The functions of those parts remain to be considered. They may first be viewed as a whole, and then specially. The protection which the skin affords the body, the skin as an organ of sensation and of touch, and as a regulator of heat, the cutaneous respiratory function, and the functions of secretion, excretion, and absorption, all call for special recognition. Some of these are more important than others. The normal action of these functions is liable to be interfered with in many ways, and deviations from the normal state produce certain more or less marked symptoms. Thus, through obstruction of one kind or another, or through more positive disease, their action may be in part or wholly disturbed. The welfare of the individual may in this way be slightly or seriously compromised. These several physiological offices will be discussed separately.

EPIDERMIS AND EPITHELIUM.

It has been truly said that man, like quadrupeds and birds, consists of a framework, a covering without, and a lining within. The frame is composed of bone, muscle, and blood; the covering, of skin and mucous membrane. Man has also been with propriety likened to a tube, with a covering on the outside and a lining on the inside, the outer covering being the skin, and the inner being that more extensive tract invested with epithelium. In embryology the covering is spoken of as the epiblast, and the lining as the hypoblast. The outer covering is the ectoderm, the inner the endoderm, and between the two is the mesoderm, the skeleton, with its muscular, vascular, and other attachments.

The outer covering with its epidermis and the inner lining with its epithelium are similarly composed, the former being adapted to resist light, heat, and external agencies, the latter being constructed to exist in darkness and moisture. They are united, one being the continuation of the other, and they complement each other in many ways. Both are covered with epithelial cells, which in the one case constitute epidermis, and in the other epithelium.

These coverings play a most important part not only in health but also in disease. Their numerous involutions of the skin, in the form of follicles and glands, producing through their functional activity secretions and other products, together with the enormous epithelial surface within the body, likewise largely follicular and glandular, constitute the most active and proliferating tissue of the body. They are consequently the seat of innumerable modifications and alterations in type in their relation to one another and to the structures contiguous and adjacent, giving rise to so-called "diseases."

The whole epithelial covering of man, without and within, exposed as it is to countless influences, gives forth varied products, some normal, many abnormal. The forms of these products, moreover, are varied, some being gaseous, as the breath and the exhalations from the skin; others fluid, as the sweat and the tears; some viscid, as saliva, mucus, and sebum; others solid, as the epidermis and its modifications, constituting hair, nail, horn, and teeth.[1]

THE SKIN A PROTECTING ORGAN.

The skin, as a whole, guards the economy from innumerable external agencies from without, including heat and cold, and various mechanical and chemical agents. It also serves as an outer limiting membrane, and thus acts as a barrier to the subcutaneous structures and to the fluids of the body. It is a protecting organ, therefore, in a double sense.

The corneous layer of the epidermis performs a most important service in limiting the evaporation of water from within, without which medium this process would take place too rapidly. In the performance of this function the corneous layer is aided materially by the coating of oily matter from the glands, which is always present in variable quantity. The presence of this oily matter, moreover, prevents the horny layer itself from being acted upon too rapidly by fluids. The corneous layer, which is practically impermeable, also serves as a protective covering against the absorption of acids, caustics, and other deleterious substances, whether in a gaseous, a fluid, or a solid state, this protection being aided by the presence of glandular oily secretions. As has been pointed out in considering the anatomy of the corneous layer, the epidermis tends to grow inwardly into the corium, and thus pressure is exerted upon the cutaneous capillaries, with the result of regulating the flow of the several fluids of the body.

The corium, or true skin, is an elastic, dense, tough tissue, well adapted to withstanding shock and injury from without. The hairs, especially upon the scalp, also aid in strengthening the skin and in shielding it from the various harmful influences to which it is exposed. These appendages, moreover, protect the skin from heat as well as from cold.

The subcutaneous connective tissue covers projecting parts, and enters into various depressions and spaces, giving the general rounded form to the body. In this layer is formed the adipose tissue, so useful and important to the cutaneous covering, and upon a certain amount of which depends the beauty of the external form. It acts as a soft and yielding pad, and protects certain parts, as the palms, the soles, and the nates, from external pressure. It also acts as a protective covering, and as a cushion, for the hairs and glands, as well as for the nerves and blood-vessels.

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[1] See an article on "Skin Products," by Wallace Wood, of New York, in Jour. of Nerv. and Ment. Dis., 1888, vol. xv. p. 446, to which the author is indebted.

TACTILE SENSIBILITY.

The skin, being highly endowed with nerves and special nerve-endings, is an organ of common sensation, conveying feelings or sensations of varied kinds to the nerve-centres. Thus, through it we distinguish between heat and cold. It is the seat, moreover, of certain peculiar sensations, as pain, burning, scalding, smarting, itching, shooting, pricking, creeping, tingling, and tickling. Another kind of sensibility is that due to direct touch, known as TACTILE SENSIBILITY, through which knowledge is obtained of the objects with which we come in contact. The sense of pressure, and the various degrees of hardness and softness, smoothness and roughness, and other opposite qualities, are thus recognized. The sense of touch is exceedingly developed, and may be cultivated far beyond the normal, as in the case of blind persons. It is noteworthy that dealers in human hair determine the qualities, and consequently the commercial value, of the article, chiefly by the touch. Erasmus Wilson[1] gives the case of a buyer of silk who by the touch alone was able to distinguish forty different varieties of texture of that substance.

Tactile sensibility varies in different parts of the body, being greatest in the pulps of the fingers and least in the middle of the limbs, as shown by the experiments of Weber with a pair of compasses. Thus, upon the pulp of the middle finger the two points are felt when separated from each other to the extent of only one-third of a line; on the palmar surface of the same finger it is necessary to separate them two lines; on the cheek, five lines; on the forehead, ten lines; on the middle of the breast, twenty lines; and on the middle of the arm and thigh, thirty lines. Weber, moreover, noted that the delicacy of perception was greatest in the direction of the branches of the nerves, as transversely on the face and longitudinally on the fingers.[2] Thus, the soles and palms, armpits, and sides of the trunk are the most sensitive regions to tickling; whereas the nipple, though highly endowed with the sense of touch, is comparatively insensible to the friction of the clothing and to pressure.

The sensibility of the skin may also be tested with the constant or induced electric current with electrodes of metallic needles. A series of charts illustrating the relative sensibility of the skin on thirty-nine different points of the body to the various impressions of electricity, temperature, and pressure has been prepared by Bernhardt.[1] Tactile sensibility also varies considerably with the amount of epidermis present, being increased in proportion to its thinness or absence, as in certain pathological states.

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[1] Diseases of the Skin, p. 44. London, 1867.

[2] Quoted by Erasmus Wilson, loc. cit., p. 44.

Abnormal states of the sense of locality are occasionally met with. Thus, the application of cold water to the scalp produces in some persons a sensation which they refer to the skin of the loins (Stirling); sometimes in pricking the skin, when only two points are applied, three are felt (Brown-Séquard); and Landois found upon himself that pricking the skin of the sternum over the angle of Ludovicus was accompanied by a sensation in the knee.[2] Sometimes when a prick is applied to the right side the sensation is referred to the left, and *vice versa*, as Ferrier has shown. In certain diseases marked modification of sensibility takes place, sensation being either augmented, as in hyperæsthesia, or diminished, as in anæsthesia, or variously modified, as in pruritus and dermatalgia.

PERIPHERAL NERVES.

The skin is supplied with nerves possessing several distinct functions, designated MOTOR, connected with striped and smooth muscle; SECRETORY, governing the secretory cells; and TROPHIC, controlling tissue-change and nutrition. In addition to these, the VASO-MOTOR NERVES are to be referred to.

VASO-MOTOR NERVES.

The VASO-MOTOR, or VASO-CONSTRICTOR, NERVES, which are supplied to all the non-striped muscles of the arterial system, are under the control of the medulla oblongata, and possibly the cord, and play an important part in the physiology and pathology of the skin, their action being most powerful upon the blood-vessels of peripheral parts. They regulate the condition of the blood-vessels and the blood-supply. They possess, therefore, a controlling influence upon temperature. Stimulation of this centre causes contraction of the arteries and increased blood-pressure, and paralysis of this centre causes relaxation and dilatation of the vessels. There is doubt about the existence and mode of action of trophic nerves in a strict sense; as Charcot and others have shown, the nutrition of most of the peripheral parts depends upon the influence of the spinal cord.

PAIN.

Pain is due to a stronger stimulation than normal of the sensory nerves. This may be caused by mechanical, chemical, thermal, or electrical action, or may be the result of disease. The intensity depends upon the region, and upon the excitability of the nerves.

Pain may be produced by stimulating a sensory nerve in any part of its course, but the sensation is always referred to the peripheral end of the nerve, although the seat of irritation may be at any point along its course. An example explanatory of this statement is found in the cicatrix of an amputated extremity, where the pain is referred to the part removed. When the nerves of the skin are in a state of painful excitation from inflammation or other form of disease, in which the slightest touch, or even the contact of air, causes pain, the condition is designated CUTANEOUS HYPERALGIA.

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[1] Die Sensibilitäts-Verhältnisse der Haut. Berlin, 1874.

[2] Human Physiology, by Landois and Sterling, 2d ed. London, 1886.

TEMPERATURE SENSE.

An important function of the skin is that of the temperature sense, by which we take cognizance of heat and cold and its variations. The acuteness of the thermal sense varies with different localities. When the skin is deprived of its blood there is a feeling of coldness of the part. An increased temperature, on the other hand, gives a sense of warmth. At certain temperatures pain is felt. Illusions as to the sense of heat and cold are common: thus, cold weights are judged to be heavier than warm ones (Landois).

Regarding the sensations of heat and cold, researches conducted with delicate instruments show that the skin is provided not only with spots sensitive to touch sensations, but also with "heat spots" and "cold spots," or minute localities disseminated over the surface, some of which are sensitive to heat, others to cold. Goldscheider's[1] experiments show that the whole of the back is very sensitive to cold, and only moderately so to heat, and that the forehead and the chest manifest a like peculiarity.

The skin shows remarkable instances of differences in the perception of temperature: thus, as Weber has shown, if the two hands be immersed in water of the same temperature, that in which the left is placed will feel the warmest, while the right is the most sensitive to touch. A weak impression made upon a large surface of skin produces a more powerful effect upon the nerve centres than a strong impression upon a small surface.[2] For this reason the hand is better adapted than the finger to test the temperature of water.

PERIPHERAL TEMPERATURE.

Couty[3] finds that each person has a special palmar temperature, as determined by the clinical thermometer, varying within a limited range, and but little affected by external conditions. Digestion causes a rise, and during the night there is a decrease. The temperature is markedly affected by variations in the nervous irritability of the individual, from whatsoever cause. In disease, the changes of the peripheral (palmar) temperature always give a precise representation of the course of the process, and often of the extent of its complications. The curve thus obtained varies more than that for the central temperature. During fever the palmar temperature rises relatively higher than the axillary, and the two tend to coincide or even do reach the same height.

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[1] See review of Goldscheider's article on the "specific energy of the nerves of sensation of the skin," in Monatsh. für prak. Derm., 1884; also a review of the works of other writers on the same subject by Max Joseph in same journal, Bd. v., 1886, No. 8.

[2] Quoted by Wilson, loc. cit., p. 45.

[3] Archives de Physiol. Norm. et Path., 1880, 2e S., t. vii. p. 82.

The skin temperature in men between the ages of twenty and thirty has been found by Kunkel[1] to vary from 31° C. (88° F.), the temperature of the skin of the face, to 24° C. (75° F.) at the tip of the nose and lobe of the ear. Upon the trunk covered with clothing the skin shows a temperature of 30° to 32° C. (86° to 90° F.), while the skin of the foot indicates 26.5° to 28° C. (79½° to 84° F.).

HEAT REGULATION.

The skin acts as a regulator of bodily heat, and aids in preserving a constant temperature of the blood. The tension of the skin, which is due to the net-work of elastic fibres and to the muscular cutaneous fibres, to some extent controls the temperature. The action of heat and cold upon the skin, the one dilating and the other contracting the membrane, is seen to advantage on the tunica dartos of the scrotum, which is well supplied with muscles. The contraction of these muscles also takes place in a conspicuous degree in the hairy portions of the skin in the nervous condition called "goose-skin." With an increased flow of blood, as in inflammation, the part becomes warmer than before, but the actual heat is not greater than that of the body.

Heat passes off from the skin by the evaporation of the secretions, and also by radiation and conduction. The skin itself is not a good conductor of heat, but the presence of an increased supply of blood materially augments the conduction through this structure. The epidermis is likewise a poor conductor of heat.

The state of the atmosphere, whether moist with vapor or dry, has a decided effect on the secretion of sweat,—moisture favoring the secretion, while dry air, owing to the rapid evaporation, retards the formation of sweat.

THE TURKISH BATH.

The action of the Turkish bath may here be referred to. Flemming,[2] from a study of the physiology of this bath, summarizes its effects as follows. The temperature of the body and the pulse-rate are distinctly raised. The respiration falls at first, but later is less influenced. The urine is increased in density, and is deprived of a large proportion of its chlorides, while a slight increase in the amount of urea is produced.

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[1] Phys.-Med. Gesells. z. Würzburg, 1886; abst. in Jour. Cut. and Gen.-Urin. Dis., 1887, p. 407.

[2] Jour. of Anat. and Phys., July, 1879. See also Arch. of Derm , vol. vi. p. 74.

The principal effect upon the arterial tension seems to be an increase produced by the greater rapidity of the heart's action, combined with the dilated or gorged condition of the capillary circulation. Hence the most important effect of the bath is the stimulation of the emunctory action of the skin. During the bath large quantities of water should be taken. The elevation of the temperature, pulse-rate, and blood-pressure points to the necessity of caution in cases where the circulatory system is diseased. The results obtained by C. Lange[1] and by J. Byrne Power[2] confirm Flemming's observations on the effect of the hot-air bath upon the rate of the pulse and respiration.

DISTURBANCES OF FUNCTION.

Disturbances of the general function of the skin, whereby its several offices are simultaneously more or less interfered with, may give rise to grave results. In this case the skin may cease to perform properly its functions, one or more of these in a measure being taken up by other organs of the body, especially the kidneys. Thus, when the entire surface is covered with tar, more or less febrile disturbance, malaise, vomiting of a dark-brown fluid, headache, and greenish-black urine are liable to result. This may be due partly to disturbed functional power, but in greater part is the effect of absorption of the tar.

Experiments upon man and animals have been made from time to time in varnishing the cutaneous surface with various impermeable dressings, such as varnish, oil-paint, adhesive plaster, collodion, and tar. Socoloff's[3] experiments with animals, covering them with varnish, asphalt dissolved in turpentine, glue, and acacia, proved the operation to be fatal in its results. Clonic and tonic spasms in the muscles, a lowered temperature, albuminous urine, and parenchymatous inflammation of the kidneys were noted. The effect is different on different animals. In rabbits death sooner or later occurs after the application of varnish to the shaved surface, the symptoms being those of an acute febrile disease, followed by decrease in temperature, albuminuria, and convulsions. But rabbits seem to be particularly susceptible to such influences, for dogs survive varnishing for several weeks.

Senator has performed experiments of this kind upon man, which go to show that the operation is not so dangerous as was formerly supposed. In varnishing the skin, according to Müller's[4] experiments, the secretion of urine is decreased, rather than increased as might be supposed, which is explained by both Müller and Laschkewitch as the result of a general dilatation of the cutaneous blood-vessels, the pressure on the renal circulation thus being reduced. The question of suppressed glandular secretion will be referred to in considering these secretions.

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[1] Arch. Gén. de Med., 1880, t. i. p. 150.

[2] Dubl. Jour. Med. Sci., 1882, vol. lxxiii. p. 372.

[3] Archiv für Derm. u Syph., Heft 1, 1878.

[4] Archiv für Exp. Path., 1874.

SECRETION.

The most important function of the skin is that of secretion, which is to be considered under the heads of (1) sudoriparous and (2) sebaceous secretions. The products of both sets of glands give moisture and oil to the skin, whereby the surface is kept soft and supple, besides performing numerous other offices, including the function of excretion.

SWEAT SECRETION.

The secretion of sweat is one of the most important functions of the skin, and plays an active part in both health and disease. Sweat is secreted in the coil of the sudoriferous, sweat, or coil gland. When the fluid occurs on the surface of the skin in an imperceptible degree, evaporating as it appears, it is termed INSENSIBLE PERSPIRATION; when it occurs in increased amount, so that drops of sweat form on the surface, it is spoken of as SENSIBLE PERSPIRATION. The amount normally poured out in the twenty-four hours varies, but has been estimated at about two pounds. Roehrig[1] places the amount at less,—at one pound nine ounces troy.

As stated, it varies greatly and depends upon numerous circumstances, including the external temperature. Under certain conditions the amount may be greatly increased, so that in a hot bath, for example, as much as a pound and a half may be thrown off within half an hour. Favre collected 2560 grammes of sweat in one and a half hours, by placing a man in a metallic vessel in a warm bath.

The amount of sweat secreted varies on different regions. The palms, as a rule, give off most, then, in the order named, the soles, face, neck, axillæ, genital region, arms, and forearms.

SWEAT.

Ordinary sweat is a watery or fatty, colorless, clear fluid, with an alkaline or an acid reaction, according to circumstances. It possesses a salty taste and a characteristic odor, varying with the individual and with the region from which it emanates. The odor is due to the presence of volatile fatty acids.

According to Trümpy and Luchsinger,[2] its reaction is alkaline, although it frequently is acid owing to the admixture of fatty acids from decomposed sebum. In the palm of the hand, where there are no sebaceous glands, it is constantly alkaline. Trümpy and Luchsinger further state that during profuse perspiration the reaction becomes neutral and afterwards alkaline again. The sweat contains volatile fatty acids, chiefly formic, acetic, butyric, propionic, caproic, and capric, varying in quality and quantity in different regions of the body. Neutral fats, as palmitin and stearin, and cholesterin are also present in small amount.

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[1] Physiologie der Haut. Berlin, 1876.

[2] Pflüger's Archiv, Bd. xviii.

According to Heuss,[1] the sweat of healthy men during rest is normally acid, but when, after the administration of pilocarpine or boric acid baths, the sweat becomes profuse, the reaction is neutral or alkaline. The reaction of the sweat is to be distinguished from the acidity found in the skin as a tissue, which extends as far as the prickle-cell layer. Even when the sweat is alkaline the skin may be acid. The normal acidity of the sweat is the product of the less acid, neutral, or even alkaline secretion of the sweat glands, and of the acid and cutaneous fluid. Increase of alkalinity depends on the relative proportion of the sweat to the cutaneous fluid.

It seems to be well established that the sweat glands secrete variable products. One of these is undoubtedly ordinary sweat, which emanates especially from the smaller glands. In addition to this watery secretion, an oily, albuminous product is secreted. This, while it is formed typically in the larger glands, is also secreted by the smaller glands, as by those on the palm of the hand, where no sebaceous glands exist. The fact that an oily product is secreted on the palms has been abundantly proved by numerous investigators. The product of the sweat, or coil, glands is therefore a mixed secretion, and moreover is variable. The sweat is a product of secretion, and, as in the case of the saliva, it is under the control of the nervous system.

Under the microscope sweat contains fine fatty granules and a few epithelial cells. The inorganic constituents of the sweat comprise the alkaline chlorides, especially sodium chloride, together with traces of earthy phosphates and sodium phosphate. They average, according to Funke's analysis, about 0.329 per cent. Traces of albumen have been found, and also an unknown reddish-yellow pigment, extracted from the residue of sweat by alcohol.

Cutaneous diseases modify the secretion of sweat. Aubert's[2] observations show that, as a rule, certain diseases of the skin more or less completely suppress the perspiratory secretion, and that after their disappearance some time elapses before the secretion reappears. In cicatrices many of the glands disappear, but those which remain secrete more profusely than before.

HISTORY OF THE FUNCTION OF THE SWEAT GLANDS.

The function of the sweat, or coil, glands has been the subject of much discussion, and has been investigated of late, particularly by Koelliker[3] and Unna.[4] Koelliker expresses the view that the coil glands (*Knäueldrüsen*) produce not only ordinary sweat but also a product rich in fats and albumen, with grades intermediate between the two extremes. Unna is also of opinion that all sweat glands contain and secrete fat at times, which, though similar to that of sebaceous glands, is different from it, as stearic acid and margaric acid are different from oleic acid. He is of opinion that the correctness of this observation can at any time be proved both on sections of the skin and in the sweat of the hand, by means of treatment by osmic acid.

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[1] Monatshefte für prak Derm., Bd. xiv., Nos. 9, 10, and 12.

[2] Le Progrès Médical, 1877, p. 679.

[3] Handbuch der Gewebelehre des Menschen, erster Band, p. 259, Leipzig, 1889; also in his Mikroscopische Anatomie, Leipzig, 1850–54.

[4] Ziemssen, Handb. der Spez. Path. und Ther., Bd. xiv. S. 93; also Trans. Internat. Med. Cong., London, 1881; and Brit. Jour. of Derm., Sept. 1894.

According to Unna's[1] historical investigation, F. Simon was the first to notice fat in sweat. Koelliker, in 1853, found fat in normal skin only in the sweat glands of the axilla, and in the small sweat glands yellow granules, this product being comparable to that of the ceruminous glands of the ear, which contain yellow granules and fat. Koelliker called attention to the fact that the ordinary sweat glands, the axillary glands, and the ceruminous glands constituted an unbroken order of development.

In 1857 G. Meissner put forth the view that the sweat glands generally were the producers of fat, going further than Krause the elder and Koelliker in attributing to them the function of fat formation exclusively. He stated that he had "always found fat in considerable quantity in all these glands wherever they might be, and the shining droplet which often appears in the aperture of the glands of the palm of the hand on an objective glass consists mainly of fat, which partly crystallizes when cold." Henle, in 1861, while stating that Meissner's arguments in proof of the formation in the sweat glands of fat which is destined to oil the skin were convincing, adopted a more moderate view, in effect that "the sweat glands as a whole secrete fat, and, besides that, at times watery sweat without fat." This view is now held by Unna and others, including the author.

CONDITIONS INFLUENCING SECRETION.

Perspiration varies in different persons, the average secretion being about double that excreted by the lungs, or about one-sixty-seventh the body-weight. It is influenced both by reflex and by central stimulation. The effect of temperature on the secretion is marked. Increased temperature of the surroundings causes the skin to become reddened and to secrete and pour out sweat profusely; cold, on the other hand, by preventing the supply of arterial blood, decreases or arrests the secretion. Vascular and muscular activity, by acting on the blood-pressure of the cutaneous capillaries, produces an effect similar to that of heat; while the internal use of warm water, in the form of copious drinks, as is well known, increases the secretion.

The action of certain drugs on the secretion is marked; for example, pilocarpine, strychnine, muscarine, nicotine, Calabar bean, picrotoxine, camphor, and ammonia compounds increase the flow, while others, as morphine and atropine, tend to diminish or arrest it. Atropine paralyzes the nerves of the glands, and morphine acts in like manner to a less degree.

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[1] Brit. Jour. of Derm., Sept. 1894.

SWEAT GLANDS AND KIDNEYS.

The complementary relation between the sweat glands and the kidneys may be alluded to, the action of these two sets of organs being in inverse ratio. When the skin is active, as in summer, the kidneys separate less water, while in winter, when the cutaneous capillaries are chilled, the urinary secretion is increased. Upon mechanical grounds there exists, moreover, a distinct relation between the secretion of the sweat glands, the urinary secretion, and the movements of the bowels. When the urinary secretion is copious, as in diabetes, and where watery stools occur, the skin is usually dry. Urea is a normal constituent of sweat, and exists in the proportion, according to Funke and Picard,[1] of about 0.1 per cent., though variations occur. It has been found from evaporation of the sweat in a crystallized state on the surface of the skin by Schottin and Drasche, in certain, especially uræmic, diseases.[2] According to Leube, when the secretion of sweat is greatly increased the amount of urea in the urine is lessened, both in health and in uræmia.

J. Byrne Power's[3] experiments show that nitrogen is excreted by the skin in all cases, but in quantity so small that it is difficult to believe that the cutaneous excretion can ever act vicariously with the renal to any appreciable extent, even in cases of gout and in Bright's disease. Some investigators, as Voit, Ranke, and Purkis,[4] have denied the existence of nitrogen in the sweat, but some of their experiments were made upon the lower animals, and hence are not conclusive.

INFLUENCE OF NERVES ON THE SECRETION OF SWEAT.

The researches of Luchsinger[5] show that the dominating sweat centre is situated in the spinal cord as far up as, or in, the medulla oblongata. Adamkiewicz[6] has shown that when the medulla oblongata is stimulated in a cat, the hairless soles of all four feet (the only regions on which the cat sweats) sweat even three-quarters of an hour after death. According to the studies of Vulpian[7] and Adamkiewicz, the peripheral paths of the sweat nerves follow the rami communicantes to the sympathetic, and then join the mixed nerves of the extremities. P. Coyne[8] has shown the endings of the sweat nerves upon the sweat glands in the cat.

The secretory nerves control the secretion of sweat, as has been shown experimentally by stimulation of these nerves upon the lower animals after complete arrest of the circulation. Landois[1] is of opinion that the secretory nerves and those for the blood-vessels lie in the same nerve trunks. The secretory fibres for the head are in the thoracic sympathetic, pass into the ganglion stellatum, and ascend in the cervical sympathetic. M. Meyer[2] has shown that cutaneous electrical stimulation of the cervical sympathetic in man causes sweating of that side of the face and arm. The secretory fibres of the anterior extremity are found in the ulnar and median nerves for the fore-limbs of the cat. A sweat centre for the upper limbs also lies in the lower part of the cervical spinal cord. Adamkiewicz found that stimulation of the central ends of the brachial plexus caused a reflex secretion of sweat upon the foot of the other side. The secretory nerves for the hind limbs of the cat lie in the sciatic nerve, as shown by the experiments of Luchsinger. The course of the fibres of secretion to the sciatic nerve is variable, some, according to Vulpian, passing directly from the spinal cord, others, according to Luchsinger, Nawrocki, and Ostroumow,[3] passing into the abdominal sympathetic through the rami communicantes and the anterior spinal roots from the upper lumbar and lower dorsal spinal cord, where the sweat centre for the lower limbs is seated.

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[1] Quoted from Landois, op. cit., p. 668.

[2] See Uridrosis for further observations.

[3] Dubl. Jour. Med. Sci., 1882, vol. lxxiii. p. 369.

[4] Quoted by Power, loc. cit.

[5] Pflüg. Arch., 1877, 1878.

[6] Die Secretion des Schweisses. Berlin, 1878.

[7] Compt.-Rend., 1878.

[8] "Sur les terminaisons des nerfs dans les glandes sudoripares de la patte du chat." Compt.-Rend. Acad. d. Sc., Paris, 1878, 86, p. 1276.

The sweat centre may be excited directly by a venous state of the blood, as in dyspnœa, as seen in the secretion of sweat that sometimes precedes death; by overheated blood pouring through the centre; and by certain poisons, already referred to. The centre may also be excited reflexly, though with variable results, as Luchsinger has shown by stimulation of the cervical and peroneal nerves; while mustard in the mouth is capable of inducing perspiration on the face. Luchsinger has noted that the use of pepper in a case caused the formation of drops of sweat on the forehead and the bridge of the nose. The secretion of sweat may be induced by psychical conditions, as anxiety and the like.

Sweating must be regarded as a process of true secretion.

SEBACEOUS SECRETION.

The product secreted by the sebaceous glands is designated SEBACEOUS MATTER, or SEBUM. It is a fatty substance, and in healthy persons within the glands is a fluid or semi-fluid substance of variable consistence, tending in some instances to become firmer or of cheesy consistence within the duct. As is well known, in certain localities where the glands are large it may sometimes be expressed upon the surface as rounded, worm-like, whitish or yellowish, tallow-like masses or plugs. Commonly it exists on the surface of the skin as a greasy or oily coating.

In chemical composition the sebum is for the most part fatty, being chiefly in the form of fluid olein and solid palmitin fats, cholesterin, soaps, an albuminoid, and the alkaline chlorides and phosphates. Microscopic examination shows free fat, fatty cells, cell débris, cholesterin crystals, and epidermic scales. The vernix caseosa and the smegma præputialis are similar in composition, and are a fatty mixture of macerated epidermic scales and sebaceous matter and the product of the sweat glands. Cerumen, or ear-wax, is a mixture of the product of the sebaceous and coil glands. The secretion of the Meibomian glands is sebum. Sebaceous matter in some persons contains a microscopic mite, the DEMODEX FOLLICULORUM, which, so far as is known, is a harmless creature.

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[1] Op. cit.

[2] Quoted from Landois, op. cit., p. 671.

[3] Quoted from Landois, op. cit., p. 671.

The chief function of this secretion is to lubricate the hairs and to keep the skin normally greased. It is a true secretion, and, as in the case of that of the sweat, or coil, glands, is under the control of the nervous system, and is subject to variations. The difference between a physiological and a pathological process is often ill defined. The general observations made on the influence of the nerves on the secretion of sweat apply with almost equal force to the sebaceous secretion. From clinical studies the author is of opinion that the two sets of glands act in concert, both in health and in disease, more commonly than is generally admitted by physiologists and pathologists. Thus, hyperidrosis of the palms and soles, as well as of the face, sometimes accompanies severe pustular acne and also seborrhœa of the face, the two secretions acting abnormally together.

ABSORPTION.

The skin possesses absorptive properties, various substances entering the system through this medium, especially under favorable conditions. The channels through which this process takes place are still questioned, the most plausible theory, however, being that which involves the follicles. There are certain natural barriers to free cutaneous absorption. Thus, the oily coating arising from the glands, which is always present in variable degree, covers the whole surface, and acts as a protective coating against absorption from noxious and other substances. This secretion also prevents undue evaporation of the fluids of the body. It exists not only upon the general surface, but also in the hair-follicles and in the ducts of the glands. If this be removed, as Parisot[1] showed, absorption may readily and rapidly occur. The corneous layer of the epidermis, consisting of a compact mass of stratified corneous cells, likewise acts as an obstacle to absorption.

The normal intact skin, it may be said, is almost impervious to watery solutions. Where the corneous layer of the epidermis, however, is defective or macerated, absorption takes place readily, as numerous experiments and clinical observation prove. The live and succulent cells of the mucous layer and the papillary layer of the true skin absorb easily, the juice-spaces and lymphatics taking up fluids very readily, as proved by experiment upon a blistered or an excoriated surface.

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[1] Gaz. des Hôp., 1863.

The epidermis permits a certain, though extremely small, amount of fluid to filter through its layers into the skin. The action of water upon the epidermic cells causes them to swell, through imbibition of the water. They are also more or less loosened by the process of soaking, the permeability of the structure being in this manner increased. Long immersion in the bath gives an increase in body weight, this being the result of the epidermis taking up water by imbibition rather than of fluid entering the system.

SUBSTANCES IN SOLUTION.

Medicinal substances in solution, as iodide of potassium, are to some extent taken up by the epidermic cells, and may subsequently be regained in part by washing out, as Keller[1] has shown. Whatever be the avenue, medicinal substances in solution certainly enter the system in variable amount under favorable conditions, in proof of which statement there is abundant experimental and clinical evidence. Keller[2] found that mineral-water baths were distinctly diuretic, while sweet-water baths were followed by a decrease of urine; and that mineral-water baths increased the chlorides, and sweet-water baths decreased them. The influence of cold, in the form of cold packing and cold showers, markedly increases the secretion of urine; while hot applications, in the form of cloths wrung out of hot water, lessen it (Müller[3]).

The absorption and elimination of iodide of potassium with the urine, through the vapor bath, take place, according to Bremond,[4] at about two hours after the bath; and elimination after a single bath ceases altogether after twenty-four hours, irrespective of the quantity of the salt in the vapor or the temperature or duration of the bath. Where, however, ten baths have been taken, elimination continues for three or four days; and where twenty-five or thirty have been taken, it continues ten or twelve days after the last bath. The importance of having the skin well cleansed with soap in order to obtain the best results from the absorption of medicinal substances is well known, as Bremond[5] has pointed out in his experiments with a vapor obtained from water in which iodide of potassium was dissolved. Unless the skin had been thoroughly cleansed, absorption did not occur below a temperature of 100.4° F., but if the skin had been well cleansed, absorption took place at a temperature varying from 93.2° to 96.8° F. The salt commences to be eliminated with the urine about two hours after the bath.

SUBSTANCES IN OILS OR FATS.

It is a well-recognized fact that the mercury of mercurial ointment is absorbed into the system through the skin, but there is a difference of opinion among physiologists as to the manner in which this takes place. Some believe that the particles pass through the epidermis (Fleischer, Rindfleisch); others, that they enter through the hair-follicles and sebaceous glands (I. Neumann and others). The latter view seems the more plausible when the structure and form of the epidermic covering are taken into consideration. V. Voit found globules of mercury between the layers of the epidermis, and even in the corium, of a person who was executed, into whose skin mercurial ointment had been previously rubbed. The mercury globules in mercurial inunction pass into the hair-follicles and ducts of the glands, where probably they are affected by the secretion of the glands and transformed into a compound capable of absorption.[1]

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[1] Monatsh. für prak. Derm., Bd. xi., 1890, p. 215.

[2] Monatsh. für prak Derm., Bd. xiii., No. 1, p. 27.

[3] Amer. Jour. of Derm. and Syph., vol. v., 1874, p. 318.

[4] Jour. of Anat. and Phys., Nov. 1872.

[5] Jour. of Anat. and Phys., Nov. 1872.

Substances dissolved or suspended in oils or fats are absorbed more readily when mechanical pressure is employed, as is observed when inunctions are practised. It is recognized that the presence of hair upon the surface is favorable for absorption, which would favor the view of this process taking place through the follicles. Lassar's[2] experiments upon rabbits go to show that fats and the substances contained in them are readily absorbed, probably through the hair-follicles. Fleischer,[3] however, opposes Lassar's views as to the permeability of the uninjured skin for various drugs, dissolved either in water or in oils. He takes the ground that no absorption occurs where the epidermis is intact, and that the occurrence of albuminuria after styrax applications for scabies, and of olive-green urine after inunction with tar ointment, points to a defective epidermis.

SUBSTANCES IN A DRY STATE.

Certain substances in a dry state and in powder form, as, for example, sulphur, are taken into the system through the skin. Thus, Bouvard,[4] having wrapped a limb in sulphur powder for the cure of sciatica, found subsequently the system saturated with the drug, with a strong odor from the skin and the urine, together with acne and itching, all the symptoms disappearing in eight days. With the view of testing this observation, the experiment was repeated with the same results, the symptoms being slower in disappearing.

GASEOUS SUBSTANCES.

Gases from without pass through the skin with considerable ease, as proved by experiments, the epidermis not being the same obstacle as in the case of fluids. Roehrig found that a rabbit whose body was enclosed in a vessel of sulphuretted hydrogen, in such a manner that the gas could gain access to the system through the skin only, died with symptoms of this poisoning. In a bath containing sulphuretted hydrogen this gas is absorbed, while carbonic acid gas is given off into the water.

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[1] Landois, op. cit., p. 673.

[2] Virchow's Archiv, Bd. lxvii.

[3] Virchow's Archiv, Bd. lxxix. S. 558.

[4] Lond. Med. Record, May 20, 1889.

It is well known that sulphur baths act favorably in lead-poisoning through the absorption into the system of their gaseous constituents.

VOLATILE SUBSTANCES.

Volatile substances, such as hydrocyanic acid, chloroform, and ether, also camphor and turpentine, are absorbed by the unbroken skin. Roehrig[1] found that after contact of the hand with turpentine until a feeling of strong burning was experienced (ten minutes), care being taken that the oil could not gain entrance to the body in any other way, the urine passed immediately possessed an odor of violets, and when camphor was employed instead of turpentine, an odor of camphor. Solutions of iodide of potassium, digitalin, and curarin, under a certain pressure upon the arm, in from twenty minutes to two hours were found to enter the body, as determined by their appearance in the secretions or by their physiological effects. According to Roehrig, all volatile substances which act upon and destroy the continuity of the epidermis are capable of absorption.

GALVANIC CONDUCTION.

Galvanic conduction may take place through the skin. The introduction of dissolved substances through the skin by means of the constant current is known as the "cataphoric action" of the constant current, so called by Du Bois-Reymond. The two electrodes are impregnated with solutions of certain substances (as, for example, iodide of potassium or quinine) and applied to the skin, the direction of the current being changed from time to time. In this manner certain substances may enter the system and be passed in the urine. The introduction into the system of dissolved substances through cataphoresis takes place, according to Ehrmann,[2] through the hair-follicles and the mouths of the sebaceous glands.

RESPIRATORY FUNCTION.

The skin respires to some extent, the process being analogous to that which takes place through the lungs. The amount of oxygen taken up by the cutaneous surface is small, according to Gerlach[3] only as 1 to 137 as compared with the lungs. Water and carbonic acid gas are undoubtedly excreted, but it seems uncertain whether, even in small amounts, the same can be said for nitrogen and ammonia.

As Roehrig[4] states, the greater part of excretion by the skin is in the form of water. The amount of carbonic acid gas given off during a stated period varies in proportion to that from the lungs from 1 : 25 to 1 : 92. The reason the excretion by weight from the lungs appears to be so much less than that by the skin is found in the fact that the lungs are constantly absorbing oxygen. The actual transpiration through the lungs is more than double that indicated by the loss of weight. According to Regnault and Reiset,[1] the oxygen taken up by the skin is either equal to or slightly less than the carbonic acid given off. The carbonic acid excreted by the skin is only $\frac{1}{220}$ of that excreted by the lungs, while the oxygen absorbed is $\frac{1}{180}$ of that taken in by the lungs. Thus it will be noted that the respiratory activity of the skin is slight.

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[1] Archiv für Derm. u. Syph., Heft 1, 1873, abst. from Archiv der Heilkunde.

[2] Wiener Med. Wochenschr., No. 5, 1890.

[3] Quoted by Roehrig, op. cit., p. 36.

[4] Die Physiologie der Haut. Berlin, 1876.

Von Paalzow[2] finds that baths of water rich in carbonic acid gas do not increase the respiration. Powerful irritation of the skin, such as is produced by mustard, on the other hand, causes increase both in the amount of carbonic acid evolved and in that of oxygen taken in. The amount of carbonic acid gas daily excreted by the skin is placed by Reinhard[3] at 2.23 and by Aubert at 3.87 grammes. It is augmented by exercise and increased temperature.

The amount of water thrown off daily by the skin, according to Seguin,[4] is about double that from the lungs, which estimate seems to be corroborated by more recent investigators. The amount is put down at about 600 grammes, although this cannot be regarded as fixed, the process varying greatly with the individual and the conditions, as the season, temperature, food, drink, and clothing.

It has been estimated that a healthy man loses daily by the skin $\frac{1}{67}$ of his body weight (Seguin), which is greater than the loss by the lungs in the ratio of 3 to 2 (Valentin). From 150 (Scherling) to 60 (Aubert) grains of the entire loss is due to carbonic acid, the rest being in the form of water (from 1½ to 2 lbs.), with a few salts in solution.[5] Salkowski[6] estimates the daily loss of epidermis from a healthy person to be almost inappreciable.

REGENERATION OF SKIN.

The epidermis and the several epithelial appendages are regenerated by proliferation from the deeper layer of epithelial cells. The reproduction of cells is a prolific process, division of the cells and nuclei taking place actively. The nucleus plays an important part in the division of the cells, conformably with the process known as karyokinesis, or indirect division of the nucleus. Cells continue to be reproduced until the lowest layer and the bed are destroyed, when repair takes place from the margins. The glands and the hair-follicles also play an important part in the regeneration of epithelium, a point to which attention has not been sufficiently directed. This is notable especially in the case of burns and scalds of the general surface. Skin may be transplanted from one locality to another, where under favorable conditions the excised portion attaches itself to the tissues beneath and grows, the epithelial tissues in particular exhibiting a ready disposition to the production of new structure.

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[1] Quoted by Landois, op. cit.

[2] Pflüger's Archiv, 1872, p. 492; Jour. of Anat. and Phys., Nov. 1872.

[3] Quoted by Ziemssen, Hand-Book of Skin Diseases, p. 67. New York, 1885.

[4] Mém. de l'Acad. de Paris, 1790, et Annales de Chimie, t. xc.

[5] Quoted by Landois, op. cit., p. 278.

[6] Virchow's Archiv, Bd. lxxix. S. 555.

According to Donders,[1] the eyelashes are changed in from three to five months, and the other hairs more slowly. The rate of the growth on the head is about six lines a month, being more rapid in youth than in old age. Concerning the influence of the frequency of hair-cutting on the growth of the hair, Berthold and Moleschott[2] have proved that the ordinary notion that frequent cutting increases the production is correct. The oftener it is cut the faster it grows, and the same observation is true for shaving the beard. The growth of the hair is stronger in summer than in winter, and more by day than by night. The nail grows from the root forward. The finger nails attain their full growth in four or five months, and those of the great toe in about twelve months.

PROPERTIES OF HAIR.

Hairs are very strong, and are capable of supporting considerable weight, the hairs of the head supporting at least six ounces without breaking; they are, moreover, remarkably elastic and admit of great extension. This occurs to the extent of nearly a third of their length, and when stretched out a fifth they contract again so completely that they remain extended only one-seventeenth beyond their original length (Koelliker[3]). They absorb and give off water readily; they also take up fatty and oily substances. They contain no blood-vessels or nerves, but are nourished from their papillæ. In composition they consist of a nitrogenous substance containing sulphur, fat, pigment, and mineral salts. According to Von Laer,[4] hair is composed of 47 per cent. carbon, 25 per cent. oxygen, 17 per cent. nitrogen, 6 per cent. hydrogen, and 5 per cent. sulphur. Hair is insoluble in water, but dissolves in alkalies and in hydrochloric and sulphuric acids. Chlorine first bleaches it and then converts it into a resinous matter resembling turpentine. When heated it becomes hard, swells, and emits an odor of burnt horn, and in the open air takes fire, burns with a bright flame, and leaves a residue of charcoal (Watts). Many salts and metallic oxides, also certain organic substances, change the color of red or white hair to black, as nitrate of silver in ether or in lard. Hairs retain their characteristics unchanged for a very long time, and are the last portion of the body to give way to decomposition.

CHOLESTERIN.

Liebreich[5] in 1885 stated that cholesterin fat, or "lanolin," exists in the tissues containing keratin, especially in the human epidermis, hairs, and vernix caseosa, and later repeated this observation. Lewin[1] expressed the same opinion. F. Buzzi[2] was the first to oppose these statements of Liebreich and of Lewin. A. Santi[3] concludes from his investigations that there is no cholesterin fat, and therefore no lanolin, in human skin. Lanolin may be said to be found only in sheep wool; all other horny tissues contain cholesterin in considerable quantity, but no lanolin. Cholesterin occurs, however, more extensively in the body than was formerly supposed, the human subcutaneous fat, the ordinary animal glycerin fats, and the liver all being rich in this substance.

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[1] Quoted in Landois, op. cit.

[2] Untersuchungen zur Naturlehre des Menschen und der Thiere, Bd. xii.

[3] Manual of Human Micros. Anat., London, 1860.

[4] Quoted from Dict. of Chemistry, by H. Watts, London, 1882.

[5] Ueber das Lanolin, eine neue Salbengrundlage, Berl. Klin. Wochen., No. 47, 1885.

GENERAL SYMPTOMATOLOGY.

Symptomatology, or semeiology, might be studied with almost equal propriety in connection with the special pathology of the skin, of which it is a part or division. For practical purposes, however, it is convenient to study the subject from the stand-point of mere symptoms,—of abnormal manifestations, changes, and sensations having their seat in the integument. Symptomatology viewed thus deals with the various signs of disease. It is a most important subject, for from a knowledge of the signs we learn to understand their meaning, and thus are enabled to recognize and classify diseases. It may be regarded as elementary and at the same time introductory to special pathology.

The diseases of the skin exhibit themselves in the form of symptoms, simple or complex in character, which are either objective or subjective in nature. Objective symptoms consist of certain manifestations which occur in the skin, and are for the most part the result of structural alteration in the integument. The processes which occasion the lesions need not be considered here, for it is with their form, shape, distribution, and the like, and with their general characters and behavior, that semeiology is concerned. The lesions comprise the external forms to which diseases give rise, and consequently are capable for the most part of ocular demonstration. The so-called primary lesions are the external signs of disease, mainly of inflammation and of new growths, going on in the several strata of the integument or in connection with the appendages of the skin. The secondary lesions, as, for example, ulcers and crusts, represent the results of the pathological processes, and indicate effete products and altered or destroyed tissue. Subjective symptoms, on the other hand, relate to sensation, such as pain, itching, and burning, and their several modifications, of which the patient alone is able to take cognizance.

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[1] Microchemischen Nachweis von Cholesterinfett in der Körnerschicht der Epidermis. Berl. Klin. Wochensch., 1886, No. 2.

[2] Monatsh. für prak. Derm., Bd. viii., Feb. 15, 1889, No. 4.

[3] Monatsh. für prak. Derm., Bd. ix., Aug. 15, 1889, No. 4.

Symptoms involving the general economy in connection with the disease of the skin, as manifested, for example, through the vascular or the nervous system, must also be referred to. Thus, certain acute and grave maladies are accompanied by more or less fever, general debility, or marasmus; in other instances disordered digestion or menstruation, or functional disturbance of other organs, is noted; while sometimes organic disease of one or another internal organ of the body is found to exist. All symptoms, indeed, of whatsoever character, should receive attentive consideration. The symptoms represent the alphabet of dermatology, and must be learned before the various diseases can be comprehended and the whole subject understood. The manifestations which occur in the skin are to be read by the trained observer as a page of a book. Upon a correct interpretation of the symptoms depend not only the diagnosis but also the indications for the treatment. For the diagnosis of most cutaneous diseases no further information than that furnished by the integument is required. For the successful treatment of the case, however, the history and other information may be of great assistance.

OBJECTIVE SYMPTOMS.

The skin is subject to more functional disturbances and alterations of structure than any other organ of the body. It is attacked not only by most of the pathological processes that occur in other parts of the body, but in addition by many that are peculiar to this organ. That the lesions produced by these numerous processes should be varied in their character is not remarkable.

Under the head of OBJECTIVE SYMPTOMS are to be studied the various lesions capable of demonstration which occur in the skin. They comprise both the primary and the secondary manifestations, are numerous, and are, moreover, capable of undergoing innumerable modifications. It is the many and peculiar modifications of the typical lesions that render the study of the diseases of the skin so perplexing and difficult of comprehension. The modifications in many diseases are as common as the typical expression. On the other hand, the typical lesions are the rule in some diseases, as, for example, in herpes zoster and psoriasis. They may be divided into those which show themselves as primary forms of disease, termed primary lesions, and those which exist either as the result of primary lesions or from other causes, designated secondary lesions. The importance of obtaining a just appreciation of these morbid changes cannot be over-estimated. Upon their recognition depends the ability to establish correct diagnoses.

PRIMARY LESIONS.

MACULES.

Syn., Maculæ; Spots; *Germ.*, Flecke; *Fr.*, Taches.

MACULES ARE VARIOUSLY SIZED, SHAPED, AND COLORED AREAS OF ABNORMAL SKIN, DUE TO VARIED CAUSES, UNACCOMPANIED BY ELEVATION OR DEPRESSION.

The macule is much less sharply defined than most of the other primary lesions. The term employed to express the macular, or spotted, manifestations which occur upon the skin irrespective of the pathological process which has caused the lesion. The macule is, therefore, like the other primary lesions, strictly a clinical expression. The general characteristics of macules may first be referred to. They are of various sizes. Thus, they may be as small as a pea or a bean, or as large as a hand. In outline they are usually roundish, but they may be irregular or even angular in shape. They may be ill defined or circumscribed. In color and tint they vary exceedingly; they may, in fact, be of any color, the more common, however, being reddish, yellowish, and brownish. They are the manifestations of diverse causes, and consequently illustrate numerous pathological processes. They are the commonest of the elementary lesions. They are evanescent or permanent, with innumerable intermediate stages, according to their nature. They disappear or remain under pressure, as they are of one kind or another, and may or may not be accompanied by subjective symptoms, depending upon the cause which produces them.

The simplest and commonest variety of macule is that caused by hyperæmia, or congestion, and called ERYTHEMATOUS MACULE, examples of which are of constant occurrence in connection with numerous disorders. They occur especially in the hyperæmias and inflammations, but are of frequent occurrence in the hypertrophies and atrophies, particularly among the pigmentary affections, less so in the neoplasmata. They very frequently occur as diffused or circumscribed patches or spots of congestion, with a variable degree of hyperæmia or inflammation.

Macules are generally symptomatic of some disturbance or disease of the general economy. In some of the specific exanthemata, as measles, they exist as a marked feature of the disease. When the erythema is circumscribed and small, the condition is known as ROSEOLA, which, however, designates merely the form of the lesion, and not the cause; thus, roseola may be the manifestation of some slight disorder of the alimentary canal or of one of the infectious diseases. These spots are generally symptomatic, as in typhoid fever. They may result from arterial fluxion or from venous stasis. Where inflammatory products are present the lesion may be circumscribed and slightly raised, taking on the modification known as the maculo-papule. The macule may also show signs of inflammatory œdema. The erythematous rings or zones which often surround other lesions, as pustules, are designated AREOLÆ, or halos, and are usually distinctly inflammatory in character.

Macules, or stains, may also result secondarily from inflammatory changes, due to deposit of the coloring matter of the blood or pigment in the skin, such as occur in syphilis and in lichen planus. They may also be the result of hemorrhage into the tissues of the skin, when they occur as reddish, bluish, or purplish marks which do not disappear under pressure. Such are met with in simple purpura and in various other diseases in which diapedesis has occurred. Flat vascular or pigmentary growths in the skin, as some nævi, are also often macular in form.

Alterations in the pigmentary function of the skin likewise give rise to macules, which may be due to either an increase or a deficiency of the normal coloring matter. In some diseases macular manifestations due to both excess and deficiency of pigment deposit occur simultaneously. Thus, vitiligo presents an instance in which the lesions are due to an increase and to an absence of the pigment, both atrophy and hypertrophy taking place side by side. Similar pigmentary changes are met with in lepra. The yellowish spots termed chloasmata, observed for the most part about the face in women, occasioned by the presence of an excessive amount of usually more or less irregularly deposited pigment, may also be mentioned. Another form, due to the same cause, is found in lentigo, or freckle; still another, yellowish or brownish in color (due to a vegetable growth, the microsporon furfur), in tinea versicolor.

When abnormal coloring of the skin involves the whole or a large portion of the surface in a uniform manner, the condition is designated a DISCOLORATION, examples of which are observed in jaundice, Addison's disease, leprosy, and other diseases; also in the staining of the skin resulting from the prolonged internal use of nitrate of silver. The pigmentary deposits, or so-called STAINS, accompanying or following certain diseases, such for example as occur in lichen planus and syphilis, and known as SECONDARY PIGMENTATIONS, may also be referred to; likewise chemical stains, as those resulting from the external use of iodine, nitrate of silver, and other substances.

PAPULES.

Syn., Papulæ; *Germ.*, Knötchen; *Fr.*, Papules.

PAPULES ARE CIRCUMSCRIBED, SOFT OR FIRM ELEVATIONS OF THE SKIN, VARYING IN SIZE FROM A PIN-HEAD TO A PEA.

They are of various shapes, some being acuminated, some rounded, while others are polygonal, flat, and angular. They are encountered in numerous diseases; are due to a great number of causes; and have their seat in different structures of the skin. Thus, they may be situated in the corium; in connection with the sebaceous glands; or about the hair-follicles. They may be inflammatory, as is usually the case, or may be due to new growths, hypertrophies, or other processes. In color they are usually reddish, pale or dark in shade according to the disease and circumstances.

Papules are of many varieties, the more prominent of which are the following. The commonest is that which consists of a small circumscribed plastic exudation in the skin. This finds its typical expression in papular eczema, in lichen planus, in papular acne, and in prurigo. In some cases papules are more or less umbilicated, as in lichen planus. Inflammatory papules may or may not undergo metamorphosis into other lesions; thus, not infrequently they pass on into vesicles and pustules, as in eczema and acne, constituting papulo-vesicles and papulo-pustules, or they may break down and become ulcers, as occurs in syphilis and carcinoma. Various inflammatory processes tend to form about the hair-follicles, giving rise to papular lesions. Another variety is made up of accumulations of epidermic cells, arranged concentrically around the entrances of the hair-follicles, forming conical elevations, as in keratosis pilaris. Closely allied to such formation is that which occurs in comedo, which may be considered a modified form of papule. Another variety forms about the sebaceous glands, as in sebaceous cyst and in adenoma sebaceum. Still another consists of a circumscribed collection of epithelial cells, producing a small, whitish or yellowish, semi-globular elevation, as observed in milium. They may also be formed by hypertrophy of the normal structures of the skin, as the papillæ, examples of which may be observed in ichthyosis and wart. Finally, hemorrhage into the skin may give rise to papules, as occurs in purpura papulosa.

The duration of papules varies with their nature, as in the case of the other cutaneous lesions. They may be acute, chronic, or permanent. They may disappear by absorption, as in the case of most of the inflammatory varieties, or they may disappear spontaneously or be removed by mechanical or other means, as may take place in epithelial molluscum and milium. Inflammatory papules are in the course of their evolution frequently surmounted by accumulations of scales, more particularly during the stage of decline. When such are present, the lesion receives the name of a SQUAMOUS PAPULE, a condition of common occurrence in syphilis and in lichen planus. The disappearance of inflammatory papules, especially those of long standing, is apt to be followed by more or less pigmentary deposit, as occurs strikingly in lichen planus and in syphilis. Papules may or may not be attended by itching, this symptom, as well as others of a similar kind, depending upon the nature of the disease. Those of eczema are remarkable for the violence of the itching which they occasion. In some inflammatory papular diseases itching is a notably variable symptom, as in lichen planus.

VESICLES.

Syn., Vesiculæ; *Germ.*, Bläschen; *Fr.*, Vésicules.

VESICLES ARE CIRCUMSCRIBED, ROUNDED OR ACUMINATED, YELLOWISH, REDDISH, OR WHITISH ELEVATIONS OF THE EPIDERMIS, VARYING IN SIZE FROM A PIN-POINT TO A PEA, CONTAINING CLEAR OR OPAQUE FLUID.

They are of different colors, according as their contents are pure serum, sero-purulent matter, serum mixed with blood, or sweat. When recent, the common inflammatory types have clear contents and a yellowish, usually glistening hue. They may be either fully or partly distended with fluid, and their walls may be tense or flaccid. As a rule, they rupture readily, discharging their contents over the surrounding surface. Certain vesicles, however, as those of herpes zoster and sudamen, are tenacious, and do not break unless exposed to violence. In form they are rounded and circumscribed, and either possess a dome-like roof or are more or less acuminated. They may have an even, rounded or irregular surface, or they may have slight depressions on their summits or about their walls.

Anatomically they have their seat sometimes between the mucous and horny layers of the epidermis, in other cases within the mucous layer, and may thus be either superficial or deep-seated. They may also be due to collections of sweat in connection with the gland ducts. Their seat varies with the process, and also with the locality and with the thickness of the epidermis, especially the horny layer. They may be single or compound, consisting of one or of several chambers: single vesicles are seen, for example, in sudamen; compound vesicles in herpes zoster, and in dermatitis from rhus poisoning. As a rule, they are inflammatory, the degree of inflammation attending them, however, not being so marked as in the case of papules or pustules. In many instances they seem to be produced by direct nerve influence, and in this respect they resemble blebs.

Vesicles, as a rule, do not remain as such for any length of time,—rarely more than a few days, when they either rupture, the fluid becoming a crust, or retain their contents, in which case they are absorbed, or they may pass into a purulent condition and thus become vesicopustules or pustules. Sometimes they pass progressively into blebs, a striking instance of which frequently occurs in dermatitis herpetiformis. The changes which they undergo vary in different diseases, and even in the same disease. They may also coalesce, as in eczema, and thus undermine the horny layer of the epidermis.

Vesicles rarely occur singly. They almost always appear in numbers, either in the form of aggregations, as in eczema, or in distinct groups, as in herpes zoster. They may occur upon all parts of the body, more especially upon those regions where the epidermis is thin and protected; but they are also encountered in the palms of the hand, assuming here, however, a peculiar form, owing to the thickened horny layer. This structure modifies the vesicle considerably; thus, where the horny layer is thick, as on the palms and soles, the exuded fluid tends to undermine the epidermis in sheet form rather than to form discrete lesions. They are usually accompanied by burning and itching sensations; but at times such symptoms are absent.

BLEBS.

Syn., Bullæ; *Germ.*, Blasen; *Fr.*, Bulles.

BLEBS ARE IRREGULARLY SHAPED ELEVATIONS OF THE EPIDERMIS, VARYING IN SIZE FROM A PEA TO A GOOSE-EGG, CONTAINING CLEAR OR OPAQUE FLUID.

They vary exceedingly in size, and have no definite form. Large and small blebs may occur simultaneously side by side. They may appear either singly or in numbers, but are rarely so numerous as vesicles, nor do they usually incline to group. When recent they are generally of a pale yellowish color; when their contents become turbid they are whitish or yellowish; containing blood they are reddish or brownish, and often are streaked. Their fluid is serous, and offers an alkaline or a neutral chemical reaction.

They usually possess strong walls, do not tend to rupture spontaneously, and, as a rule, consist of a single chamber. They are generally distended, often to their utmost capacity; in some instances, however, they are only partly filled and remain flaccid. At times they are weak and break before they are perfectly formed, leaving their shattered walls attached to the skin in the form of shreds, as noted in pemphigus foliaceus. Their bases sometimes show an unhealthy, eroded or vegetating surface, bloody or purulent secretion, with maceration and crusting, as in pemphigus vegetans and syphilis. The walls usually rise directly from the surface of apparently healthy skin, without, as a rule, marked signs of inflammation, but occasionally areolæ are present. Like vesicles, they have their seat in the superficial or deeper layers of the epidermis, their intimate structure corresponding to that of vesicles. They are seldom attended by marked itching or burning sensations. In some forms of pemphigus, however, these symptoms are positive.

They are encountered in pemphigus, pemphigoid eruptions, dermatitis herpetiformis, various forms of dermatitis, erysipelas, herpes iris, syphilis, leprosy, and occasionally as a complication in some other diseases. A combination of blebs, vesicles, and pustules is occasionally met with, as in dermatitis herpetiformis. Their presence generally indicates a weak, poorly innervated skin, and where they are flaccid a cachectic or depraved condition usually exists. As a result of diseases arising from within, they must in most cases be regarded as indicative of general debility or a depressed state. They are not infrequently due to disease of nerves or to general nervous depression, as in pemphigus.

PUSTULES.

Syn., Pustulæ; *Germ.*, Pusteln; *Fr.*, Pustules.

PUSTULES ARE CIRCUMSCRIBED, ROUNDED OR IRREGULAR, FLAT OR ACUMINATED ELEVATIONS OF THE EPIDERMIS CONTAINING PUS, VARYING IN SIZE FROM A PIN-POINT TO A FINGER-NAIL.

They are due to varied and diverse causes. They either originate as pustules or become pustular by transition from vesicles or papules. Thus, all stages from the vesicle to the pustule are frequently encountered, such lesions being designated vesico-pustules. The transition of papule into pustule, as in the miliary syphiloderm, is also common, a mixture of papules, papulo-pustules, and pustules being of frequent occurrence; and a similar evolution takes place in variola, constituting the POCK of this disease. As in the case of the vesicle, the pustule is often multilocular, or made up of separate chambers, so that when pricked only a portion of the fluid exudes. The individual cells, moreover, are soaked with the exudation, the lesion thus being something more than an accumulation of pus. Pustules are sometimes umbilicated, as seen in variola and in syphilis. Inasmuch as they always contain puriform fluid, they have a yellowish-white or yellowish opaque color; but not infrequently they also contain blood, when they possess a bright or dull reddish tint, often streaked.

There are several well-defined varieties of pustule, their chief differences resting in their seat, mode of development, and structure. The pustule of acne, for example, has its seat in a sebaceous gland, and that of sycosis in a hair-follicle. Both of these forms are deep-seated, and are peculiar, owing to the anatomical relations. The hair-follicle is a common seat of the lesion in numerous inflammatory diseases. In ecthyma and pustular eczema the suppuration is chiefly in the mucous layer. The larger and broader varieties of pustules tend to assume a flat form, as occurs in ecthyma and in syphilis. As a rule, they are accompanied with areolæ, which are frequently extensive, and characterized by active inflammation, as in ecthyma, and at times by induration, as in furuncle. Pustules are for the most part unaccompanied by prominent subjective symptoms; in some cases, however, heat, burning sensations, and pain are present, as in the highly inflammatory forms of sycosis and in ecthyma. Much itching is rarely noted. They are often tender to the touch.

Their course and duration vary according to their nature, but they usually incline to a rapid termination. They either rupture, forming a thick, yellowish, greenish, or brownish crust, or desiccate, without breaking, leaving a dry, friable, often bulky crust, as in eczema. The crusts of eczema, especially in infants and on the face, are generally of more varied color than in any other disease. Excoriated surfaces often take on suppurative action, crust over, and form pustules; this is observed in eczema and also in pediculosis of the scalp and of the body. It will thus be noted that the skin is particularly liable to suppurative processes, which are due to a great variety of causes, internal and external. Pustules may or may not be followed by cicatrices, this termination depending upon the nature of the lesion, and also upon the extent to which the process has involved the corium. The scars resulting from variola, as well as from acne, sycosis, and syphilis, are well known.

WHEALS.

Syn., Pomphi; Urticæ; *Germ.*, Quaddeln.

WHEALS ARE CIRCUMSCRIBED, ROUNDED OR FLATTENED, ELONGATE, OR IRREGULARLY SHAPED ŒDEMATOUS ELEVATIONS OF A FUGITIVE OR EPHEMERAL CHARACTER.

In size they vary extremely. They may be not larger than peas, the size of a finger-nail, or as large as the palm of the hand, produced in the latter case by the confluence of smaller lesions. The average size is that of a pea or a bean. In rare instances they form discrete hemispherical elevations of considerable size, occasionally as large as a small hen's-egg. They may occur singly and discretely, but are apt to appear in numbers, and when near to one another exhibit a decided inclination to coalesce. By the process of coalition large surfaces often become more or less involved in patches or as a continuous sheet. In form they ordinarily manifest themselves as ovalish or bean-shaped elevations, tending to assume an elongate rather than a rounded shape; they also occur in the form of streaks, lines, or bands, irregular in outline. Their color is usually rosy or reddish-pinkish, often with pale or whitish centres, with more or less marked areolæ. Sometimes they present a shining aspect, owing to the tension of the skin consequent upon the circumscribed œdema. In duration they are generally fugitive or ephemeral. They usually form rapidly, often in a few minutes, and, remaining a longer or shorter time, disappear rapidly or slowly, in most cases much more slowly than they came. Sometimes they are followed by more or less pigmentation, which may be slow in disappearing. Their course is generally capricious.

They have their seat in the papillary layer or in the body of the corium, and are produced by a sudden effusion of fluid into the meshes of the corium, followed by immediate contraction of the capillaries, the vessels being for the time in a state of spasm. Upon relaxation the fluid is absorbed, the wheal disappearing rapidly or slowly. The process is peculiar, and is a typical expression of angioneurosis. The lesion may contain suddenly exuded serous fluid, as in simple urticaria, or a mixture of serum and blood, as in urticarial purpura. The typical wheal is seen in the sting of the common nettle, and in urticaria arising from various internal causes. Wheals are occasioned by many and varied causes. Their manifestation is accompanied by characteristic tingling, burning, and itching sensations, which are generally distressing.

TUBERCLES.

Syn., Tubercula; *Germ.*, Knoten; *Fr.*, Tubercules.

TUBERCLES ARE FIRM, ROUNDED OR IRREGULARLY-SHAPED, USUALLY CIRCUMSCRIBED, PEA-SIZED ELEVATIONS OF THE SKIN, SEATED IN THE CORIUM OR SUBCUTANEOUS TISSUE.

In shape they are usually circumscribed, but they possess no definite form; thus, they may be more or less semi-globular, more or less acuminated, flat or flattened on their summits, or irregular in outline. Their color is usually reddish, but this feature depends upon their nature. Thus, in molluscum fibrosum they are flesh-colored or pinkish. Where they are due to inflammatory products or to new formations they are apt to exhibit a yellowish-red, dull-red, or brownish-red color, as occurs in syphilis, lupus, lepra, and carcinoma. They are ordinarily of firm consistence, and have their seat usually in the corium or in the subcutaneous connective tissue. In structure they are similar to the inflammatory varieties of papules, frequently being in reality exaggerated papules involving deeper tissues and a more extended surface. But their presence has a meaning quite different from that attached to papules. They are the result of various causes, as in the case of papules, but are produced mainly by the so-called neoplasmata,—new growths due frequently to specific inflammations. Syphilis, lupus, leprosy, carcinoma, myoma, neuroma, and xanthoma all give rise to marked examples of tubercle.

They undergo varied changes in their involution, according to their nature and circumstances. They are either absorbed or break down and ulcerate and are followed by scars, or establish themselves and remain permanent, as in molluscum fibrosum. In some of the neoplasmata, also, they may remain for months or years without undergoing much change. It will be observed that the term tubercle, as used to express one of the primary lesions in dermatology, refers only to the form of the lesion and in no sense to its nature. It must, therefore, not be confounded with a more recent meaning of the word as applied to a product of tuberculosis, with which it has nothing in common.

TUMORS.

Syn., Tumores; Phymata; *Germ.*, Knollen; *Fr.*, Tumeurs.

TUMORS ARE VARIOUSLY SIZED, SHAPED, AND CONSTITUTED, FIRM OR SOFT PROMINENCES HAVING THEIR SEAT IN THE CORIUM OR SUBCUTANEOUS TISSUE.

The definition is vague, but the term is of use clinically. They are of all sizes, from a pea to an egg and larger; sometimes they attain the size of a fist, as in carcinoma, sarcoma, and granuloma fungoides. They usually tend to assume a rounded or a semi-globular form with a broad base, as in epithelial molluscum, carcinoma, syphilis, and many other diseases, or are pedunculated, as in many cases of fibroma molluscum. They are more or less well defined, or may be vague and ill defined, according to their nature and expression. Their color may be the same as that of the contiguous skin, but where due to inflammation, simple or specific, they are reddish, variable as to shade. The skin covering them may remain intact or may break down and excoriate, thus giving rise to suppurating, bleeding, or crusted formations, as in granuloma fungoides and carcinoma. They usually rise above the surrounding skin to a variable elevation, and, on the other hand, extend more or less deeply into the tissues beneath; in other cases they are flat or flattened on their summits, as in carbuncle. They are occasioned by a great variety of causes, as, for example, alterations in the sebaceous glands, various inflammations and new formations in the corium and connective tissue, and new growths of the blood-vessels and lymphatics. They may or may not be painful, subjective symptoms depending on their nature, as well as upon other causes.

SECONDARY LESIONS.

CRUSTS.

Syn., Crustæ; *Germ.*, Borken; Krusten; *Fr.*, Croûtes.

CRUSTS ARE MASSES OF DRIED EFFETE MATERIAL COMPOSED OF THE PRODUCTS OF CUTANEOUS DISEASE, IRREGULARLY SHAPED AND SIZED, AND USUALLY YELLOWISH OR BROWNISH IN COLOR.

They are variable as to size and form, their features depending upon the nature of the process which has occasioned them, as well as frequently upon the length of time during which they have existed; thus they may be large, thick and bulky, or thin and flat. They generally possess a granular, rough, uneven exterior, with clefts, fissures, and ridges over the surface. In some diseases they tend to assume a shell-like formation. In variola, occasionally, and in some disorders of the sebaceous glands, the crusts take on a cornified or hard character. They are adherent to the skin or partially detached, according to their age and the nature of the disease. Partially detached, or "stuck on," crusts are observed strikingly in impetigo contagiosa. Being due to serous or puriform exudation, they are usually yellowish or brownish, but they may be greenish or blackish, and often are variegated, as in pustular eczema. They are for the most part formed by the desiccation of exuded fluids, as serum, pus, and blood, usually by a mixture of these fluids, together with epithelial débris.

Several distinct varieties are observed. Those resulting from an open, serous discharging surface are yellowish or brownish-yellow, friable in consistence, and as a rule without definite outline or bulk, as in vesicular eczema; those following the breaking down or drying up of pustules, especially if there be hemorrhage, are darker, more tenacious, and thicker, as in ecthyma. The crusts of syphilis are usually firmer and less friable in structure than in eczema, and frequently have a heaped-up, shell-like appearance; they sometimes have a dark greenish tint, and may be seated upon a superficial or a deep ulcer. Brownish or blackish crusts always contain more or less blood or its derivative products. Sebaceous crusts, as those of seborrhœa, are light yellow, dirty yellow, greenish, or blackish in hue, lamellated, adherent to their bed, and have a greasy feel and appearance. Another form of crust, that of tinea favosa, remains to be mentioned; here the formation is composed chiefly of epithelial cells, débris, and the fungus, the latter generally in profusion, and presents a clean or dirty, sulphur-yellow, umbilicated or cup-shaped, well-formed crust, or, if old, an irregularly shaped, broken-up crusted mass.

SCALES.

Syn., Squamæ; *Germ.*, Schuppen; *Fr.*, Squames.

SCALES ARE DRY, LAMINATED MASSES OF EPIDERMIS WHICH HAVE SEPARATED FROM THE TISSUES BENEATH.

They vary greatly in size and form, and may be large and thick or small and thin, abundant or scanty, laminated or heaped up in the centre, giving the lesion a shell-like form. In consistence they are dry and of a horny nature; they possess a harsh feel, and are more or less brittle, with a tendency to separate and to break up into their more minute elements. Such scales are observed in ichthyosis, and in psoriasis and squamous eczema. In some cases, however, they are more or less greasy, from admixture with the glandular secretions, as in seborrhœa. Their color is usually whitish or grayish, either dull and without lustre or micaceous and glistening, as in psoriasis; at times they are yellowish or dirty-yellowish, especially when due to disorder of the sebaceous glands. The quantity formed and thrown off varies with the morbid process. In some diseases scales are proliferated and thrown off from the skin in large quantity; in pityriasis rubra and in active psoriasis several handfuls, and even more, may in some cases be gathered daily. With many inflammatory diseases scaling occurs as a prominent or even the chief symptom, the nature and activity of the inflammation influencing the degree of desquamation.

Scales are at times formed in large, bulky lamellæ, or plates, and in heaps, as in psoriasis; sometimes in thin flakes, as in pityriasis rubra; in other cases, as in dry seborrhœa or in eczema, they consist of coarse or fine flakes or of flour-like or bran-like particles; in the latter event they are known as FURFURACEOUS SCALES, a typical example of which occurs in tinea versicolor. Modifications of scales are also encountered, where the product consists of a dried serous or puriform fluid together with epithelium. Thus, a mixture of scale and crust is not infrequently found in eczema, and in other diseases. They are due to a variety of causes, chief among which are the superficial inflammatory diseases and the vegetable parasitic affections. They are also met with in epithelial hypertrophies, especially in ichthyosis. They are likely to form in all cases in which there is want of proper nutrition in the skin arising from various causes, and therefore may be the product of numerous pathological changes. Scaling in the form of small or large lamellæ, constituting sometimes a localized exfoliation of the epidermis, designated EXFOLIATIVE DESQUAMATION, is met with in impaired nutrition as a result of nerve injury, such as occurs after section of a nerve.

EXCORIATIONS.

Syn., Excoriationes; Erosions; *Germ.*, Hautabschürfungen; *Fr.*, Excoriations.

EXCORIATIONS ARE VARIOUSLY SIZED AND SHAPED AREAS CHARACTERIZED BY LOSSES OF CUTANEOUS TISSUE, CONFINED USUALLY TO THE EPIDERMIS, GENERALLY THE RESULT OF LOCAL INJURY.

Their seat is usually in the epidermis, extending to the mucous layer, but not infrequently the latter layer and even the papillary layer of the corium are involved. They comprise slight wounds, erosions, abrasions of the skin, lacerations, and scratch-marks. As a rule, they heal readily and without leaving scars. They present a variety of forms, according as they happen to have been produced by one or another cause. Ordinarily they consist of puncta, lines, or streaks, generally lacerated and ragged in outline, with shreds of epidermis, variously sized and shaped, for the most part irregular, showing reddish, moist surfaces, oozing minute quantities of serum and blood which have a tendency to dry into crusts. They may be present in connection with an eruption of an itching nature, or they may exist independently of disease, as simple wounds of the epidermis produced by mechanical causes of one kind or another. Into this category falls also the condition known as "raw skin," in which from any cause the skin has been deprived of its corneous layer, leaving the mucous layer exposed, in the form of small or large areas, due to varied causes. Together with or following excoriations, especially where the condition has lasted for some time, more or less suppuration and crusting occur.

Scratching or rubbing, on the part of the patient, is the direct cause of the vast majority of excoriations. The symptoms which give rise to the desire for scratching are numerous, and are intimately connected with a large number of diseases. Most disorders of the skin accompanied by nerve irritation, whether from an internal or an external cause, occasion more or less itching and consequent scratching. If the itching be intense, the scratching usually will be violent and the marks proportionally severe and deep; if slight, as a rule, there will be but little and the lesions superficial. Excoriations occur most abundantly in eczema, scabies, and pediculosis, but they occur in some affections in which there is no itching or scratching, as in the so-called neurotic excoriations, and in other states where the epidermis is defective. All skins are not affected to the same extent by the same amount of scratching; in some the lesions are readily produced, while in others the tissues resist the injury. Thus, in otherwise healthy individuals, pruritus may exist and scratching be vigorously indulged in without causing extensive excoriations, while in other persons, especially those whose systems are in a debilitated or depraved state from want of food and proper hygiene, as in vagrants, the epidermis tends to break down readily under even a moderate degree of scratching.

If violent scratching and rubbing be continued for a long period, the skin, if affected with an inflammatory process, as eczema, becomes more or less inflamed, with or without suppuration, varying in degree in different individuals, generally resulting in considerable infiltration, thickening, and pigmentation. This state of the integument is also frequently observed in those who have suffered for a long time with pediculosis, where the skin is usually unhealthy apart from the parasite. Excoriations play an important rôle in many diseases of the skin, and should in all cases receive attentive consideration. Their number, form, distribution, and localization are in themselves often sufficient in certain diseases to establish the diagnosis. It should be kept in mind that an excoriated skin is not necessarily the result of injury, scratching, and like causes. It may be the effect of the natural process of disease, as noted in eczema, pemphigus, and other diseases with defective epidermis.

FISSURES.

Syn., Rimæ; Rhagades; *Germ.*, Hautschrunden; *Fr.*, Fissures.

FISSURES ARE VARIOUSLY SIZED AND SHAPED LINEAR CUTANEOUS CRACKS OR WOUNDS, DUE TO DISEASE IN THE SKIN OR TO EXTERNAL AGENCIES, HAVING THEIR SEAT MAINLY IN THE EPIDERMIS.

They commonly occur about the well-marked natural furrows of the skin, as about the palms, soles, fingers, and toes, but they are also encountered in other regions. They are liable to appear wherever there are movement and tension of the tissues, as about the flexures of the joints, and about the natural apertures of the body, as the mouth, nares, and anus, especially if nutrition of the part is impaired, as in eczema or syphilis. In these diseases they are of frequent occurrence. While they tend to follow the natural lines and furrows of the skin, sometimes they form elsewhere and at angles or even transversely to these lines and furrows, as occurs especially in eczema. They assume various sizes, and appear as elongate, narrow or broad, superficial or deep, reddish, dry or moist, linear openings or clefts. They may be the result of a diseased condition of the tissues, as in ichthyosis, eczema, psoriasis, and syphilis, or may be caused by local irritants, as cold, and chemical agents, or by other influences acting injuriously upon the epidermis. They are generally more or less painful, and interfere with the natural movements of the part.

ULCERS.

Syn., Ulcera; *Germ.*, Geschwüre; *Fr.*, Ulcères.

ULCERS OF THE INTEGUMENT ARE IRREGULARLY SIZED AND SHAPED LOSSES OF SUBSTANCE OR EXCAVATIONS OF THE CUTANEOUS TISSUES, THE RESULT USUALLY OF SOME PRECEDING DISEASE.

Cutaneous ulcers are characterized by a substantive loss of tissue, whether this be in the upper or the lower strata of the corium or in subcutaneous tissue. They are the result of a preceding alteration of the tissue or tissues involved. In some cases this alteration is of a simple inflammatory nature, as in the common forms of leg ulcer; in others it is due to a specific inflammation, as in lupus vulgaris, carcinoma, syphilis, lepra, and other so-called neoplasmata. The symptomatology of ulcers occupies an extensive field in dermatology, inasmuch as many and diverse diseases may at one period or another in their course be characterized by ulceration. Only the general symptoms of ulcers can be considered here, and more especially the clinical features of the commoner forms of these varied lesions.

Ulcers vary extremely as to size and shape; thus, they may be no larger than a pin-head or as large as a hand. In outline they incline to be circular, but they are often irregularly shaped, kidney-shaped, or serpiginous. Sometimes they exhibit an excavated or crater-like form, as seen in carcinoma; in other cases they have a scooped-out or punched-out form, as occurs often in syphilis. They may be superficial, shallow, or deep; not infrequently they extend into the subcutaneous structures. They present a more or less moist, bleeding, or discharging surface, which may or may not be crusted. Their bases are smooth, uneven, or irregular; are reddish in color; and are covered with a grayish, yellowish, or reddish, inoffensive or offensive secretion, which may be either abundant or scanty, according to the nature of the morbid process. Their edges are usually defined; not infrequently they are abrupt; at times they are markedly everted or undermined. Ulcers occur as a symptom in the course of a large number of diseases, chief among which are syphilis, lupus, scrofulosis, lepra, carcinoma, sarcoma, carbuncle, and furuncle. They may also be due to simple or complicated inflammatory processes, the result of impaired nutrition, venous stasis, and necrosis, as in the common leg ulcer; and to animal parasites and other irritants, varied in character. They occur during the course of certain diseases in which the nervous system, central or peripheral, is involved, and as a result of injuries to nerves or of a specific inflammation of nerves, as in lepra. Ulcers may occur upon any part of the surface, but are most frequently met with upon the lower extremities, especially the legs. Certain diseases tending to ulcerate, as syphilis, lupus, lepra, and carcinoma, however, frequently manifest themselves on the head, trunk, and upper extremities. Their duration is variable; they are seldom stationary, but show, on the contrary, a decided disposition to undergo change. Many tend to enlarge; others manifest an inclination to heal. When repair takes place it is in the form of a cicatricial tissue, which in most cases remains permanently. While pain is often present, it is a variable symptom.

SCARS.

Syn, Cicatrices; *Germ.*, Narben; *Fr.*, Cicatrices.

SCARS ARE NEW FORMATIONS, CONSISTING MAINLY OF CONNECTIVE TISSUE, OCCUPYING THE PLACE OF FORMER NORMAL TISSUE, THE RESULT GENERALLY OF INJURY OR PREVIOUS DISEASE.

While the presence of a scar implies in the vast majority of cases that this lesion is the result of an injury of one kind or another, or of an ulcer, simple or specific in nature, there are cases in which scar tissue develops independently of such antecedents. To the latter class of scars belong those which occur in connection with certain hypertrophic and atrophic diseases, as morphœa and scleroderma, atrophia cutis, and the like; with certain diseases of the class neoplasmata, as keloid; with simple and specific inflammations of the nerves, as lepra; and with lupus erythematosus. The subject of scars, like that of ulcers, covers much ground, although for obvious reasons it is of less importance than the latter. Ulcers and scars, the latter being the sequel usually of the former, should from a pathological stand-point be considered together, but regarded in the light of mere symptoms they may be discussed separately.

Scars usually have a shining or glistening, more or less contracted appearance, and are surrounded by normal skin, into which they blend, either with a line of demarcation or imperceptibly. They are in most instances smooth and soft to the feel, but often they are indurated or firm. They possess different forms or characters, according to the disease which has occasioned them; thus, they may be on a level with the skin, or, as is more often the case, somewhat depressed; at times, however, they are raised and hypertrophic. Sometimes they are linear, band- or cord-like, and in other instances, more frequently, contracted, knotted, or puckered. Their color is usually whitish, grayish, or silvery; but this varies, for if recent they may be rosy, pinkish, or reddish, while if older, grayish, yellowish, reddish, or brownish. They consist of fibrous connective-tissue elements, with blood-vessels and nerves, but do not often contain hairs, glands, and papillæ.

Scars in most cases are the result of former disease or of injury. They are known to follow all the diseases which may be accompanied by ulceration, and also injuries involving loss of substance, as burns, scalds, wounds, and caustics; and sometimes they form where no loss of tissue has occurred, as the result of simple cuts, punctures, and the like. The relation of scars of this kind to keloid, and to false keloid in particular, is intimate. Although resulting from a variety of causes, many of them are similar in character; hence they cannot be said to be positively indicative in all cases of the process which has occasioned them. At the same time they not infrequently possess certain features—as, for example, outline, number, size, texture, and location—which point unmistakably to the original disease. The experienced clinician will seldom err in estimating the antecedent history of a well-defined scar the result of disease. Scars are generally permanent, continuing to exist through life with little if any alteration. They are for the most part indolent; but in rare cases, where nerves become involved, they may be painful.

GENERAL SYMPTOMS.

All the lesions present in a case, especially if inflammatory, viewed as a whole, constitute what is known as an ERUPTION. An aggregation of lesions, whether of the same or of different character, goes to make up what is termed a PATCH of disease. The individual lesions, which are the expression of the disease of the skin, may all be of the same kind, as, for example, papules, in which event they are UNIFORM; or they may be different, of two or more kinds, macules, papules, and vesicles, and their modifications, for example, all being present, when they are said to be MULTIFORM, or POLYMORPHOUS, exemplified in erythema multiforme, so named on account of the variety of elementary lesions usually present at one time or another in its course. They may moreover be isolated or DISCRETE (DISCRETUS), or so numerous as to be closely crowded, or CONFLUENT (CONFERTUS).

The following expressions, descriptive of peculiar forms of lesion, are used in connection with certain diseases, more especially in those cases in which the lesions are both uniform and numerous: when small pin-head or millet-seed sized, MILIARIS; when pointed, ACUMINATUS; when of the size and shape of a pea or bean, LENTICULARIS, etc. Thus, common examples are found in the expressions miliary papular syphiloderm, acuminated warts, and lenticular papular syphiloderm. The terms NEONATORUM, INFANTILIS, ADULTORUM, SENILIS, etc., are frequently convenient to express concisely the time of life at which the disease occurs: for example, the sclerema of the new-born is called sclerema NEONATORUM; the eczema of infants, eczema INFANTILE, etc. The terms ÆSTIVALIS, AUTUMNALIS, HIEMALIS, applied to diseases which are peculiar to certain periods of the year, are obviously indicative of the seasons, as pruritus hiemalis, eruptio æstivalis, etc.

The terms CAPITIS, FACIALIS, BRACHIALIS, CERVICO-BRACHIALIS, DORSO-PECTORALIS, FEMORALIS, ABDOMINALIS, DORSO-ABDOMINALIS, PALMARIS, PLANTARIS, etc., are conveniently used to denote the region involved: as, for example, eczema capitis, syphiloderma palmaris, herpes zoster facialis, etc.

Color.—This necessarily varies with the nature of the pathological process, the inflammations, however, producing the most striking coloring. It also varies greatly according to the stage of the disorder, a point which must always be taken into consideration in describing the disease. In many diseases it is tolerably uniform and constant, as in psoriasis and tinea versicolor. Reddish colors, of course, prevail, and they occur in all shades and variegations from pink to vermilion and crimson. Yellow and brown in innumerable shades are also common. In some diseases at times unusual and peculiar colors, such as blue, green, and black, in light or dark shades, are noted. The coloring may pertain to the corium, to the epidermis, or to effete products, as crusts.

In some instances it is due to changes taking place in the sweat and sebaceous secretions, as in chromidrosis and rare forms of seborrhœa. Different colors and shades, either simultaneously or during the evolution and involution of the process, are often seen in the several stages of a disease, as, for instance, in erythema nodosum. The tint is, moreover, often influenced by external agencies, as by heat or cold, and also by local treatment. When an affection is characterized by a prominent and uniform color, whether evanescent or permanent, it is at times designated by a term descriptive of this peculiarity; thus, the adjectival words ALBIDUS, RUBER, FLAVESCENS, NIGRICANS, MELANODES, etc., are affixed to certain diseases, as, for example, eczema rubrum, sarcoma melanodes, and seborrhœa nigricans.

Symmetry.—This depends largely upon the process, and also upon the nervous system. The latter has been shown to be the governing influence in the production of symmetrical manifestations. The inflammations, especially those which pursue an acute course, as the acute infectious diseases, show symmetrical distribution most perfectly. Erythema multiforme and erythema nodosum both illustrate symmetry. Among the chronic infectious diseases syphilis in its early cutaneous outbreaks portrays this distribution strikingly. It is characterized by the simultaneous occurrence of the eruption upon the same regions on each lateral half of the body, as upon both arms or upon both arms and forearms and hands. More definite regions, as the palms and soles, the elbows, and the knees; also show this feature in some diseases, as, for example, eczema and psoriasis. The extremities generally show symmetrical distribution in the most striking manner.[1]

Distribution.—Great variation exists in the distribution of lesions; they may occupy the whole or the greater part of the surface, or may be localized to a small circumscribed area. They may further appear aggregated in patches,—AGGREGATUS; or they may be disseminated,—DISSEMINATUS. In some diseases the entire general surface tends to become involved, as in the case of the acute specific inflammations, dermatitis exfoliativa, and pityriasis rubra. When an eruption involves the entire surface, it is said to be UNIVERSAL; when various parts are affected, without regularity of distribution, it is DIFFUSED. Not infrequently lesions tend to group and cluster in various forms, notable examples of which are found in herpes simplex, herpes zoster, herpes iris, tinea circinata, and lichen planus. Eczema, acne, and scabies, on the other hand, illustrate disseminated lesions. The term HERPETIFORMIS is used to express the peculiar form of grouping which is exemplified in the several varieties of herpes, the lesions being papular, vesicular, pustular, or bullous, as the case may be, and clustered. The arrangement is indicative of a peculiar form of peripheral or central nerve influence.

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[1] For further information on this question the reader is referred to Testut's work "De la Symétrie dans les Affections de la Peau" Paris, 1877. For abstracts see Annales de Derm. et de Syph., t. viii. p. 385; also Archives of Dermatology, July, 1878.

Streaked, striated, or linear cutaneous manifestations are observed sometimes in inflammatory affections, as in lichen planus, but more frequently in atrophic diseases depending upon impairment of nerve function, as in morphœa, maculæ et striæ atrophicæ, alopecia areata, and ichthyosis hystrix. They generally take the course of the natural lines of the skin, on the sides of the thorax, for example, running parallel with the ribs, and not infrequently they follow the course of nerve trunks, as in some nævi, ichthyosis hystrix, warty growths, and leprosy, or they occupy areas innervated by definite segments of the spinal cord rather than by special nerve trunks, as often noted in herpes zoster. The distribution to the several organs or appendages of the skin is also important, some diseases having their seat in the sebaceous or sweat glands, some in the follicles, others in the structure of the hair or nails.

Configuration.—The lesions of the skin show themselves in a great variety of forms, and figures or patterns, especially with the inflammatory affections. Some of these are peculiar, and are characteristic and more or less constant symptoms of certain diseases, while others are common to many diseases. In other affections they manifest themselves without attempt at special configuration, as in eczema. The various forms and outlines assumed by individual lesions and by patches of disease are designated by the following suggestive terms. When they occur discretely in the form of small, pin-head sized points, the condition is termed PUNCTATUS; when of the size of drops, GUTTATUS; if as large as pieces of coin, NUMMULARIS. As an example, certain of the forms of psoriasis are known as PUNCTATA, GUTTATA, and NUMMULARIS. When a patch presents a circumscribed form it is designated CIRCUMSCRIPTUS; when rounded and sharply defined, ORBICULARIS or DISCOIDES. If it has a circular shape, it is called CIRCINATUS; when in the form of a ring, ANNULATUS, or ANNULARIS, as in tinea circinata and in certain rare erythemata. The disposition to circular shape, however, shows itself generally in an incomplete or broken form, producing segments of circles, often ill defined. The annular shape is usually caused by the lesion clearing in the centre and at the same time spreading peripherally, as seen in syphilis and psoriasis. The subject will be referred to again in connection with the mode of spreading of disease. When the lesions appear in concentric rings with the display of unusual colors, the condition is expressed by the word IRIS, as, for example, herpes iris. Patches are sometimes encountered whose margins upon one side appear unusually sharp and well defined against the sound skin; to these the name MARGINATUS is given. This condition is often seen markedly developed in ringworm of the body, and also in pityriasis rosea, especially of the macular variety.

When the patches are circumscribed and defined by an abrupt line of demarcation, as, for example, in psoriasis, the word CIRCUMSCRIPTUS is used. Sometimes such lesions, owing to their close proximity, run together and form geometrical shapes, in particular the figure eight. Some diseases, as eczema, also tend to form circular patches around natural apertures and depressions, as the anus and the umbilicus. If they arrange themselves in such a manner as to form winding or gyrate markings, a form sometimes observed, particularly in psoriasis, the term GYRATUS is employed. The designation SERPIGINOSUS is applied to those forms of disease, especially tubercles and ulcers, which pursue their course in a creeping, serpentine manner; as an instance, the serpiginous tubercular syphiloderm may be given. A linear or striate arrangement of the lesions may also take place, sometimes following nerve trunks, as in lichen planus and striæ atrophicæ.

The state of an eruption, as to its striking feature, is often denoted as follows: thus, HYPERTROPHICUS, used especially in connection with chronic inflammations, hypertrophies, and new growths, is employed to indicate an exuberant or hypertrophic condition, as in elephantiasic forms, and in lupus; EXULCERANS, when the process of ulceration is going on, as often occurs in carcinoma, sarcoma, lupus, and syphilis; HUMIDUS OR MADIDANS, when moisture is present, as in eczema; SICCUS, when there is absence of moisture, as in seborrhœa; and INDURATUS, where induration is pronounced, as occurs often in acne, and in many other diseases.

Some diseases, as those due to the presence of vegetable growths, are confined largely to the epidermis, the inflammation of the corium often present being usually secondary. These affections are for the most part dry and scaly, as is the case in tinea circinata and tinea versicolor. The papillary layer, including part of the mucous layer of the epidermis, constitutes the most active part of the skin, and is the seat of many pathological changes, notably those which occur in the common diseases eczema and psoriasis. Here the majority of the superficial inflammations have their seat, characterized by various superficial elementary and secondary lesions.

Mode of Extension.—The manner of spreading of the disease varies with the process, and also with the case. In some diseases there is a tendency to begin as a local lesion and to spread by the multiplication of lesions through new areas of infection, as in sycosis and lupus vulgaris. In others the extension takes place on the periphery, as in tinea circinata, lupus erythematosus, and psoriasis, affections widely different in their nature. In connection with the several forms which lesions in certain diseases are prone to assume, attention must be directed particularly to the circinate shape, a peculiar and well-known evolution of which is into the annular form, where the patch having cleared in the centre continues to spread on the periphery, constituting a ring, complete or broken, as noted in tinea circinata and syphilis, especially in the tubercular variety of syphilis, and also not infrequently in psoriasis.[1] Another mode of extension is in the form of a series of complete or broken rings, separated by healthy skin, two or three sometimes occurring, as seen in herpes iris and in a less marked degree occasionally in tinea circinata.

Evolution of Lesions.—This subject is of practical importance from a diagnostic point of view as well as from that of pathology. In some diseases the changes that occur from the earliest formation of the lesions to their termination are not marked by much change, the lesion, for example, beginning as a macule or as a papule and remaining such until its disappearance. Thus, in lichen planus the lesion is almost always a papule, and in tinea versicolor it is always a macule. But in the vast majority of diseases, especially those characterized by inflammation or new growth, the lesions undergo numerous and marked changes during the evolution of the morbid process. Thus, in eczema they may pass from vesicles into pustules, while many other changes are common. In scabies, dermatitis herpetiformis, herpes iris, herpes zoster, granuloma fungoides, and other diseases, the evolution is not only marked but is characteristic, thus playing a prominent part in symptomatology. Another common mode is for macular or papular lesions to become squamous, as occurs in eczema, syphilis, and other diseases. In brief, it may be stated that the evolution and involution of cutaneous lesions, primary and secondary, constitute a most important phase of symptomatology, as may be noted in connection with the history of most of the diseases.

Locality.—The aspect of a disease depends in some cases largely upon the region and locality invaded, and on the period of time that the lesions have existed. This observation is shown in many diseases, but in none more plainly than in eczema and syphilis, where not infrequently all trace of the original lesions has disappeared, followed by secondary changes entirely unlike those occurring in the beginning of the disease. The regions of the body invaded vary with the disease. Certain affections are peculiar in that they attack only particular localities; some possess a decided preference for this or that region, while others exhibit no elective point of manifestation. Thus, if the several regions of the general surface be considered, it will be found that the scalp is prone to develop eczema, alopecia areata, pediculosis capitis, tinea tonsurans, and tinea favosa; the face, lupus vulgaris, lupus erythematosus, acne, seborrhœa, syphilis, measles, variola, erysipelas, chloasma. Analyzing the face further, it is observed that the forehead is the usual seat of chloasma; the eyelids, of xanthoma, milium, and sebaceous cyst; the nose, of acne, acne rosacea, rosacea, lupus, and syphilis; the bridge of the nose and the cheeks, of lupus erythematosus; the upper lip, of herpes simplex; the lower lip, of epithelial cancer; the cheeks and chin in the male, of sycosis. The neck in front is often invaded with eczema and intertrigo, especially in infants, and the nucha with acne, furuncle, and carbuncle.

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[1] A report of some examples of "circinate eruption," by Louis Wickham, may be found in Brit. Jour. of Derm., vol. iii. p. 256.

The shoulders and back are liable to carbuncle, acne, and pediculosis corporis. Upon the chest the acute infectious diseases, as scarlatina and measles, and the erythematous syphiloderm and tinea versicolor, are generally well defined. The breasts in the female are subject to eczema and intertrigo, and the nipples to scabies, eczema, and epithelial cancer. Upon the sides of the trunk zoster generally manifests itself, and upon the abdomen the erythematous macules of typhoid fever are seen; about the nates are found scabies, furuncle, intertrigo, and congenital syphilis in infants, and upon the genital organs, eczema, herpes, scabies, pruritus, and elephantiasis. The forearms and the backs of the hands and fingers are the usual seats of erythema multiforme, and the sides of the fingers, interdigits, and wrists, of scabies.

The extensor surfaces of the limbs are prone to manifest psoriasis; the flexor surfaces, eczema. The palms and soles favor the papulo-squamous syphiloderm, and eczema; the elbows and knees, psoriasis and ichthyosis. The legs are generally the seat of chronic dermatitis, simple and specific ulcers, elephantiasis, purpura, and erythema nodosum.[1]

LOCALIZATION.

The localization of skin diseases depends upon a variety of causes, chief among which are the anatomy of the skin, the occupation and habits of the individual, and the nerve-supply to the skin. Variations in the thickness of the epidermis, the development of the papillary layer, the degree of vascularity, the sebaceous and sweat glands, the follicles and the hairs, all influence the determination of disease to one or another locality. To these must be added the supply of peculiar nervous structures to the skin, as in the case of special nerve-endings, and the action of the central nervous system through the vaso-motor system upon special regions, as the face and the extremities. Owing to this force and to the fact that the epidermis is thin and not calculated to resist external agencies nor undue blood-pressure acting from within, and that the glands and follicles are large and active, the face is specially liable to diseases of many kinds.

The localization of skin diseases depends to a considerable extent upon the anatomical structure of the skin, as has been shown by Oscar Simon.[2] The fibrous layer of the corium is arranged in definite directions, the distribution of the papillæ being determined by the longitudinal trend of the fibrous bundles, which in turn account for the arrangement of the natural furrows of the skin. The lines of localization, for example, on the neck and over the superior thoracic region converge from above outwards, and from below inwards towards the sternum; on the back they run parallel with the ribs; next to the spine, upwards, and on the outer portions, downwards; on the inguinal region they run parallel to Poupart's ligament, and on the inner side of the thigh parallel to the sartorius muscle.

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[1] For further information on this subject, an article by Pye-Smith, Guy's Hosp. Reports, vol. xxii., 1877, may be consulted.

[2] Die Localisation der Hautkrankheiten histologisch und klinisch bearbeitet. Mit 5 Tafeln. Berlin, 1873.

NERVE-SUPPLY TO THE SKIN.

In connection with the subjects of symmetry, distribution of lesions, localities and regions prone to be invaded by cutaneous disease in general, the influence of the larger nerves innervating the skin may be considered. That the nerve trunks and branches play an important part in the localization of many diseases in which the integument is involved is abundantly shown in such diseases as herpes zoster, as well as in certain other inflammations, and particularly in morphœa, hemiatrophia facialis, and other unilateral atrophies.

A knowledge of the nerves supplying the skin is important to a comprehension of the symptoms of many dermatoses, in particular those which are due to disease of ganglia and nerve-trunks, as, for example, herpes zoster. In some diseases the nerves play so prominent a part that the cutaneous manifestations are of secondary importance. The relationship of the central nervous system, ganglia, nerve trunks, branches, and filaments to the integument is exceedingly close. Many cutaneous manifestations which we are accustomed to look upon as "diseases of the skin" may be traced to the nerves and nervous centres. The nerve-supply to the skin is a subject worthy of study, a knowledge of which often aids in understanding some diseases. It helps the clinician sometimes in tracing to their source morbid processes which appear on the surface.

The cutaneous nerve-supply of the human body has been studied and elaborated in particular by C. A. Voight,[1] Jacob Heiberg,[2] of Christiania, and by C. Hasse,[3] of Breslau, all these contributions being of value to the clinician and the pathologist as well as to the anatomist.[1]

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[1] Ueber ein System neu entdeckter Linien an der Oberfläche des menschlichen Körpers und über die Hauptverästlungs-Gebiete der Hautnerven, nebst der Art der Vertheilung der Hautnerven in denselben. Sitz. Ber. d. Akad. der Wissenschaften, Math. Naturw. Cl., xxii. B., S. 240. Wien, 1857. Also, Beiträge zur Dermato-Neurologie nebst der Beschreibung eines Systems neu entdeckter Linien an der Oberfläche des menschlichen Körpers. Mit zwei lith. Tafeln in 4to. Denkschriften der Kais. Akad. der Wissenschaften, Math. Naturw. Cl., xxii. B., zweite Abth., S. 1. Wien, 1864.

[2] Atlas der Hautnervengebiete. Christiania, 1884. This work has been translated and edited, with annotations, by W. W. Wagstaffe, of London, with the title "Atlas of the Cutaneous Nerve Supply of the Human Body." London, 1885.

[3] Hand-Atlas der sensiblen und motorischen Gebiete der Hirn Ruckenmarksnerven. Wiesbaden, 1895.

F. J. Pick, of Prague, has also prepared and had published "Localisations—Tabellen bei Hautkrankheiten." Prag, 1887. These plates give the outlines of cutaneous innervation, and are intended for clinical observations in dermato-neurology.

There are three nerve territories for the entire body, one being ANTERIOR, one POSTERIOR, and the other LATERAL. The lateral is the largest of the three to each half of the body.

Anterior Surface of the Entire Body.—On the NECK there is no distribution of lateral branches, but only anterior and posterior. The line of demarcation between anterior and lateral usually divides the BREAST into two equal halves. The distribution of the anterior branches extends in the front to the thigh, but the GENITALIA, with the exception of the labia majora and scrotum, are supplied by the posterior branches, namely, superficial branches of the pudic and the small sciatic. The ARM is entirely supplied by the lateral branches. The great sciatic, or ischiadic, supplies PART of the SURFACE of the LEG.

Posterior Surface of the Entire Body.—The posterior branches of the spinal nerves take in the OCCIPUT, the BACK of the NECK, and the MIDDLE PORTION of the BACK down to about the crests of the ilia. Below this occurs the distribution of the small sciatic and the external, or short, saphenous, with so much of the continuation of the posterior tibial as supplies the PLANTAR SURFACE of the FOOT. The UPPER EXTREMITIES are entirely supplied by the anterior branches of the spinal nerves.

Head and Face,—Anterior Surface.—The nerves of the FRONT of the HEAD and FACE supplying the skin arise from the trigeminus, or fifth, nerve, the three divisions of which nerve have a different and unequal distribution.

The FIRST, or OPHTHALMIC, supplies the BALL of the EYE with sensory branches, and by the frontal, through its supra-trochlear and supra-orbital branches, innervates the entire skin of the FOREHEAD and CROWN of the HEAD as far as the lambdoidal suture. The infra-trochlear nerve, a branch of the nasal, and the lachrymal, are distributed to the UPPER EYELID, and the terminal branches of the nasal to the BRIDGE and TIP of the NOSE.

The SECOND, or SUPRA-MAXILLARY, supplies the LOWER LID, the greater part of the CHEEK and of the SIDE of the NOSE, and the WHOLE of the UPPER LIP. The branches are the infra-orbital, the inferior palpebral, the lateral nasal, and the superior labial.

The THIRD, or INFRA-MAXILLARY, supplies the LOWER PART of the FACE, corresponding nearly with the LOWER JAW, and by the auriculo-temporal branch is distributed to the FRONT part of the EAR and the skin of the adjoining TEMPORAL REGION.

Posterior Surface of the Head.—The POSTERIOR SURFACE of the

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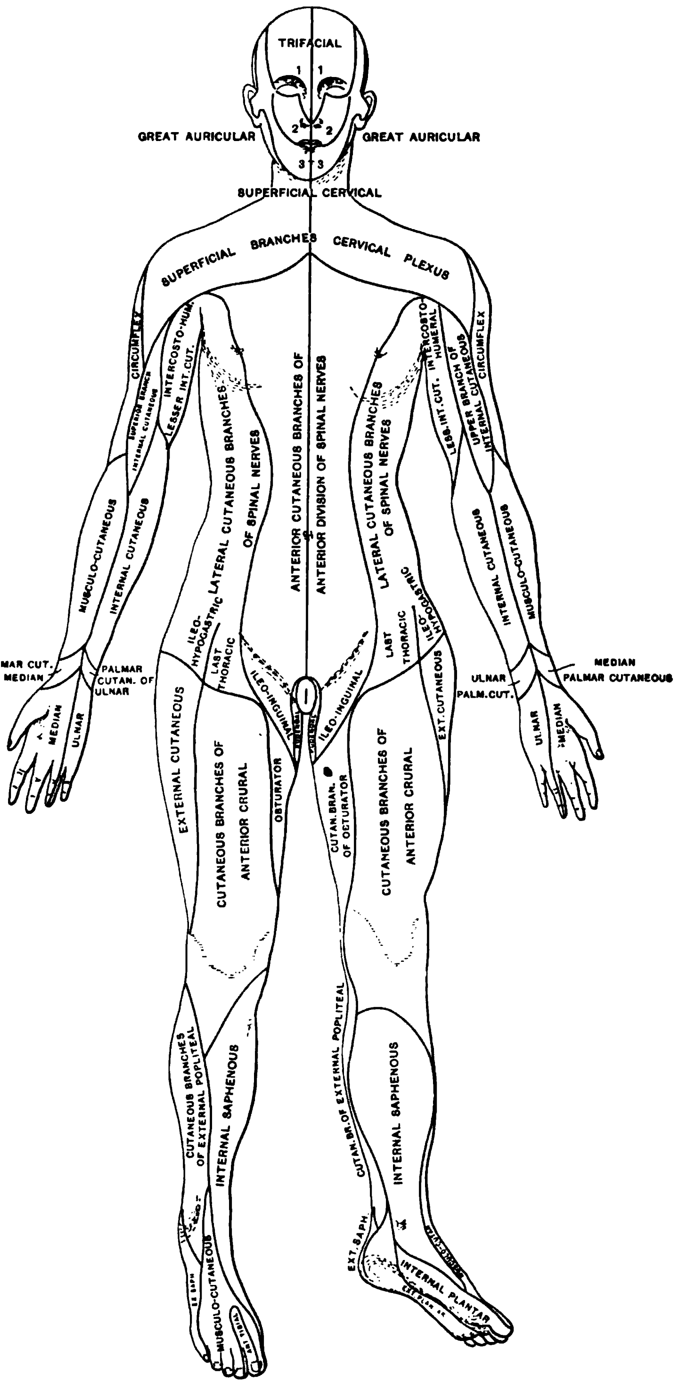
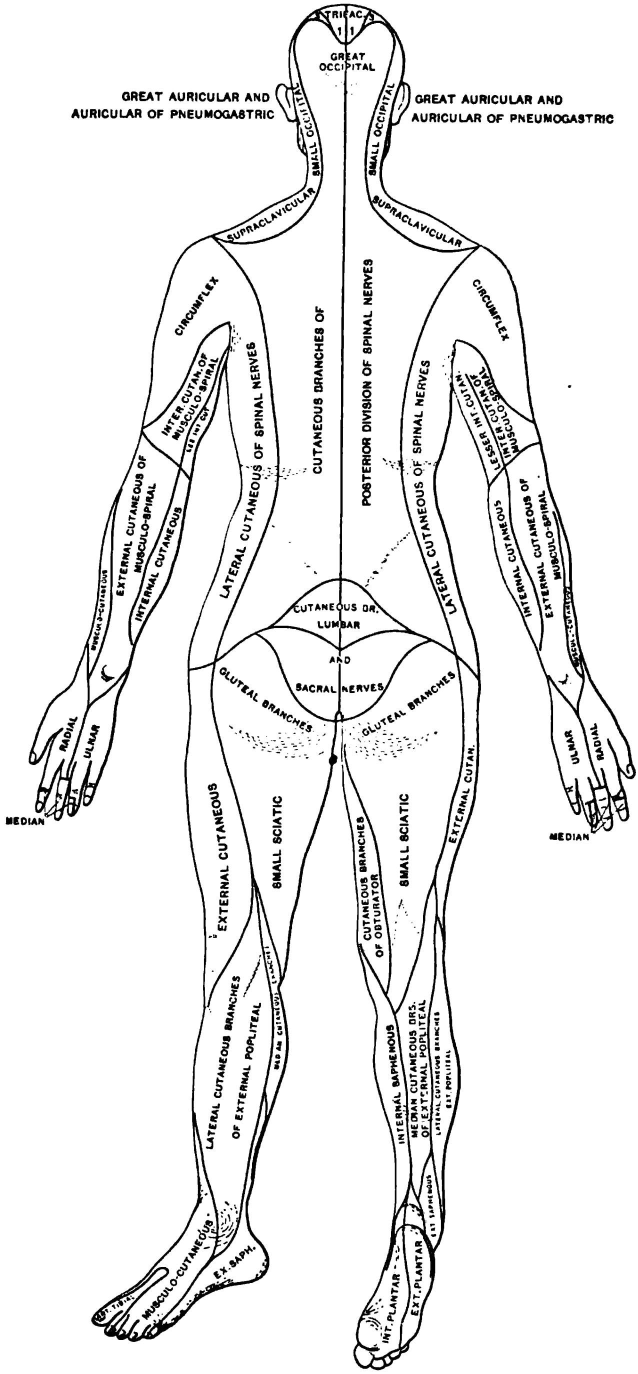
[1] In the description to be given I shall, in the main, follow or quote Heiberg, as translated by Wagstaffe, but I am also indebted to G. A. Piersol, Professor of Anatomy in the University of Pennsylvania, for aid and valuable suggestions.



NERVE-SUPPLY TO THE SKIN.
Anterior Aspect.


TRI. FAC.
GREAT OCCIPITAL
GREAT AURICULAR AND AURICULAR OF PNEUMOGASTRIC
GREAT AURICULAR AND AURICULAR OF PNEUMOGASTRIC
SMALL OCCIPITAL
SMALL OCCIPITAL
SUPRACLAVICULAR
SUPRACLAVICULAR
CIRCUMFLEX
CIRCUMFLEX
INTER. CUTAN. OF MUSCULO-SPIRAL
INTER. CUTAN. OF MUSCULO-SPIRAL
LESSER INT. CUTAN.
LATERAL CUTANEOUS OF SPINAL NERVES
LATERAL CUTANEOUS OF SPINAL NERVES
CUTANEOUS BRANCHES OF POSTERIOR DIVISION OF SPINAL NERVES
EXTERNAL CUTANEOUS OF MUSCULO-SPIRAL
EXTERNAL CUTANEOUS OF MUSCULO-SPIRAL
INTERNAL CUTANEOUS
INTERNAL CUTANEOUS
MUSCULO-CUTANEOUS
MUSCULO-CUTANEOUS
CUTANEOUS BR. LUMBAR AND SACRAL NERVES
GLUTEAL BRANCHES
GLUTEAL BRANCHES
RADIAL
ULNAR
MEDIAN
ULNAR
RADIAL
MEDIAN
EXTERNAL CUTANEOUS
SMALL SCIATIC
CUTANEOUS BRANCHES OF OBTURATOR
SMALL SCIATIC
EXTERNAL CUTAN.
LATERAL CUTANEOUS BRANCHES OF EXTERNAL POPLITEAL
MED AN CUTANEOUS BRANCHES
INTERNAL SAPHENOUS
MEDIAN CUTANEOUS BRS. OF EXTERNAL POPLITEAL
LATERAL CUTANEOUS BRANCHES EXT. POPLITEAL
EXT. SAPHENOUS
MUSCULO-CUTANEOUS
EX. SAPH.
ANT. TIBIAL
MUSCULO-CUTANEOUS
INT. PLANTAR
EXT. PLANTAR

NERVE-SUPPLY TO THE SKIN.
Posterior Aspect.

HEAD is innervated by the upper cervical nerves. The small occipital, arising from the anterior division of the second cervical nerve, supplies the skin BEHIND THE EAR, this area ending in a pointed shape towards the CROWN of the HEAD. The great occipital, representing the internal branch of the posterior division of the second cervical nerve, innervates the integument over the OCCIPITAL REGION. The anterior cervical nerves supply the skin of the FRONT of the NECK. The surface of the BACK of the NECK is innervated by the posterior divisions of the cervical nerves.

Anterior Surface of the Arm.—The skin of the SUMMIT of the SHOULDER is fed with sensory nerves arising from the supra-clavicular branches of the cervical plexus. The ANTERIOR SURFACE of the UPPER ARM may be divided into two general areas: (1) an outer, supplied by the cutaneous branches of the circumflex nerve; (2) an inner, supplied by the upper branches of the internal cutaneous, together with the lesser internal cutaneous and the intercosto-humeral nerves.

The FOREARM on its ANTERIOR SURFACE is supplied from two principal sources: the musculo-cutaneous, which occupies the OUTER HALF, and the internal cutaneous, which supplies the INNER HALF of the forearm. Towards the WRIST occur two small nerves, the palmar cutaneous of the median, and the palmar cutaneous of the ulnar.

Posterior Surface of the Arm.—While the anterior surface of the whole upper extremity is supplied with two main nerves, three exist on the posterior surface. The circumflex innervates the OUTER SIDE of the UPPER ARM. The posterior branches of the internal cutaneous, together with the lesser internal cutaneous, supply the INNER ASPECT. The upper or internal cutaneous branch of the musculo-spiral is interposed between the two.

On the FOREARM there are also three nerves distributed cutaneously throughout its length. The musculo-cutaneous sends branches to the RADIAL or OUTER SIDE; the internal cutaneous by its posterior branch supplies the ULNAR or INNER SURFACE; the external cutaneous branches of the musculo-spiral innervate the MIDDLE of the POSTERIOR ASPECT.

Front and Back of the Hand.—Three nerve distributions occur on the HAND. (1) The median supplies the larger half of the PALMAR SURFACE, including the THUMB and the next two and a half FINGERS, and the limit is indicated by a vertical line from the wrist to the tip of the fourth, or ring, finger. The median also innervates parts of the FIRST FOUR FINGERS on the DORSAL SURFACE, the MIDDLE FINGER, as far back as the middle of the first phalanx, receiving almost its entire supply from the median nerve. (2) The ulnar gives the cutaneous branches to the INNER SIDE of the PALM as far as the middle line,—one and a half fingers. The distribution of the nerve by means of its dorsal cutaneous branch extends to the DORSAL SURFACE and includes as far as the middle line. (3) The radial supplies the skin of the OUTER HALF of the DOR-

SAL SURFACE, with the exception of the tips of the first, second, and third fingers.

Anterior Surface of the Lower Extremity.—At the UPPER PORTION of the THIGH three nerves exist: (1) the external cutaneous; (2) the crural branch of the genito-crural; (3) the superficial branches of the anterior crural. The anterior crural supplies the greater part of the ANTERIOR and INNER SURFACE of the THIGH, extending as far as and even below the PATELLA by its middle and internal cutaneous branches.

The INNER SURFACE of the THIGH is additionally supplied by the cutaneous branches of the obturator, which extend even farther downwards on the posterior aspect of the thigh than on the inner side.

The long, or internal, saphenous nerve, in addition to contributing filaments to the INNER SIDE of the THIGH, innervates the INNER ASPECT of the LEG and FOOT. The cutaneous branches derived from the external popliteal nerve supply the OUTER SURFACE of the LEG.

Posterior Surface of the Lower Extremity.—On the BUTTOCKS exist the cutaneous branches of the gluteal nerves, but their distribution does not correspond with the outline of either the nates or the gluteus maximus.

On the THIGH are three nerve areas: (1) the obturator; (2) the posterior cutaneous branches from the small sciatic; (3) the posterior branches of the external cutaneous from the lumbar plexus.

On the LEG likewise three nerve areas exist: (1) an internal, supplied by the long saphenous; (2) a median, receiving the cutaneous branches derived from the external popliteal; (3) an external, supplied by filaments from the external popliteal nerve, largely through the communicans peronei, and lower down, on the OUTER SURFACE of the ANKLE, by the external saphenous.

The PLANTAR and DORSAL SURFACES of the FOOT are supplied from several sources. The plantar surface is entirely provided for by the plantar branches derived from the posterior tibial, the distribution of the plantar nerves including the DORSAL SURFACE of the TIPS of the TOES. The BACK of the FOOT is principally supplied by the musculo-cutaneous branch of the external popliteal nerve, the internal and external borders being additionally innervated by the long and the short saphenous. The anterior tibial nerve, a branch of the external popliteal, supplies the limited area included between the adjacent surfaces of the FIRST and SECOND TOES.

SUBJECTIVE SYMPTOMS.

Diseases of the skin are generally accompanied by subjective symptoms, which are varied in character, consisting of a sense of heat, flushing, burning, itching, smarting, tingling, and pain. Numerous modifications of these sensations are met with, pain in particular asserting itself in varied forms. Among the inflammations, new growths, and neuroses they are of common occurrence; while among the hypertrophies and atrophies they either are present in a variable degree or are only occasionally encountered. They may be trivial, or, as is often the case, distressing in their severity and persistency.

Disordered sensation occurs either in the form of a diminution of the normal sensibility, constituting ANÆSTHESIA, or as an augmentation of the same, termed HYPERÆSTHESIA. The former occurs in connection with diseases, functional or organic, in which the nerves are involved, especially with ascending neuritis, as in lepra, and in allied diseases. The latter may be simple or perverted in character. More or less warmth of skin or heat is present in all the hyperæmic and inflammatory affections, notably in those running an acute course. Sensations described as itching, burning, tingling, smarting, and the like are all common in the same class of diseases.

Itching.—This sensation is by far the most prominent of the subjective symptoms, and is present in varying degree in a large number of disorders. It is a particularly marked symptom usually in papular and vesicular eczema, in scabies, in dermatitis herpetiformis, and in urticaria and urticarial forms of disease. It is a terminal irritation, due to varied causes, having its seat in the skin, especially in the mucous layer of the epidermis, and is characterized by sensations which are *sui generis*. It is variously described by patients, but is peculiar in that it provokes in the sufferer a desire to scratch. It may exist in the form of a tickling or biting sensation or in a sense of formication,—as though insects were crawling over the surface. The latter is common in pruritus. The itching of pruritus is a sensory manifestation of some morbid change unaccompanied by any visible alteration in the skin.[1] Itching in general may be due to external causes, as, for example, the various parasites which attack man, or to varied internal causes, acting directly upon the nerves of the skin, especially those of the epidermis, as in local inflammatory processes, or reflexly.

Pain.—Pain, varying in kind and degree, occurs in connection with many and diverse diseases. In most cases the nervous structures, central or peripheral, are distinctly involved, the latter being often solely or chiefly implicated. Neuritis, simple or specific in nature, is a common cause of cutaneous pain, striking examples occurring in herpes zoster and lepra. The character of the pain varies with the disease, in some cases being burning, aching, or boring, in others, darting or shooting, while in still others there may be a combination of some or all of these several expressions. Pain of a continuous or paroxysmal character, usually the latter, is met with in neuroma and myoma and in dermatalgia.

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[1] For further information, see "The Sensation of Itching," by E. B. Bronson. Medical Record, Oct. 18, 1890.

GENERAL ETIOLOGY.

The subject of the general etiology of cutaneous diseases may be considered from several points of view. In order to separate it from pathology, with which it is intimately associated, and for the purpose of bringing forward its most useful features, the observations to be made will be confined as much as possible to facts and generally adopted views. As in the case of symptomatology, it will be approached mainly upon practical lines.

The causes at work in the production of the various diseases which affect the skin are manifold. It may with propriety be said that they are multitudinous. The list of etiological factors has grown immensely during the last two decades, and is still being lengthened. The causes are extremely diverse. In order thoroughly to comprehend them it is of the utmost importance that an expansive view of the subject be taken, for in many instances it will be found that the manifestations upon the surface are but indexes or direct symptoms of disorder in other portions of the system. Different causes may produce similar cutaneous lesions: thus, for example, herpes zoster, herpes iris, and tinea circinata, all characterized by herpetic lesions, are due to entirely different causes. On the other hand, the same cause, as, for instance, shock to the nervous system, may give rise to such dissimilar affections as pemphigus and alopecia areata.

SYMPTOMATIC DERMATOSES.

A large proportion of the cutaneous diseases are intimately associated with derangement of the internal economy, and are therefore, strictly speaking, SYMPTOMATIC DERMATOSES. As examples of such diseases, the polymorphous erythemata, the exanthemata, numerous inflammatory affections, some of them ill defined in character, as well as certain pigmentary and hemorrhagic affections, may be cited. The subject of the symptomatic dermatoses covers a wide field, and is intimately associated with general medicine and in particular with neurotic diseases. In many instances the skin may be regarded as a mirror in which are reflected changes due to disease in distant organs. Thus, diseases implicating the nervous system, especially nerve-centres, frequently cause abnormal states of the integument. All such affections, of whatsoever form as concerns the lesions, are to be regarded as examples of symptomatic dermatoses. The subject has been ably elaborated by Leloir,[1] with whose views the author would express himself as being in accord.

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[1] Annales de Derm. et de Syph., 1889. See also abst. in Brit. Jour. of Derm., vol. ii. (1890), p. 887.

IDIOPATHIC DERMATOSES.

On the other hand, a number of diseases have their origin in the skin itself, and are confined in their action to this organ alone; these are the so-called IDIOPATHIC DERMATOSES. To this class belong all the local diseases, as, for example, certain of the hypertrophies and atrophies, as well as those numerous conditions produced by external agencies, including parasites. It must never be lost sight of, however, that in the majority of instances of so-called diseases of the skin the relationship between the system at large and the skin is extremely close, so much so that very frequently it becomes a most difficult matter to determine to what extent a disease is local or constitutional. The line of demarcation, except in the case of diseases obviously local in their origin, can rarely be a strict one.

Etiology may be considered under the three following general heads: CONDITIONS INFLUENCING DISEASE; INTERNAL CAUSES, or those which act from within the general economy or system; and EXTERNAL CAUSES, or those which act from without.

CONDITIONS INFLUENCING DISEASE.

Age.—The periods of birth, early development, growth, and maturity are all epochs influencing disease. The tendency to disturbances of the alimentary tract in early life is a factor in the production of such diseases as the erythemata and eczema. Later in life such organs as the stomach, the liver, the kidneys, and the central nervous system are liable to be affected in one way or another, and thus become factors of cutaneous disease. In the production of disease we must take into consideration the varied circumstances under which the injurious influence occurs. Observation on this point may elicit facts which will go far towards explaining the differences in the symptoms often met with.

It is well known that some diseases are prone to make their appearance at certain periods of life, while others may appear at any time. A limited number are noted to occur only at stated ages, thus manifesting a striking peculiarity. Thus, ichthyosis first shows itself during early life, commonly in the first or second year, occasionally at or soon after birth. The congenital syphilodermata appear, as a rule, between the first and third months of life, but at times they are present at or shortly after birth. Tinea tonsurans is a disease of childhood. Impetigo contagiosa is likewise principally confined in its origin to the early years of life. Tinea versicolor, on the other hand, is extremely rarely seen in children. The vegetable parasitic diseases in general seldom occur in the old, being met with chiefly from infancy to middle age; while pediculosis of the body is only exceptionally observed in children. Carcinoma very rarely occurs in the young, seldom manifesting itself before adult age, and frequently not until old age. Pruritus in the majority of cases is an affection of adult life.

Sex.—Some diseases are to a great extent peculiar to one or the other sex, while others are noted to be more common in one than in the other. For example, sycosis is met with in the male only; epithelioma is of more frequent occurrence in the male; while Paget's disease of the nipple, impetigo herpetiformis, and lupus erythematosus are more common in the female. The most important difference between the sexes in their liability to disease in general is, that women are much more frequently affected with diseases of the generative system, and men with diseases of the urinary system. This is plainly shown by statistics in hospital service.[1] Children, male and female, differ less than adults in liability to disease, and in their constitution and peculiarities bear more resemblance to the female than to the male sex.

FREQUENCY OF CERTAIN DISEASES.

According to the figures compiled by Williams,[2] men are more than twice as subject to carbuncle as women, the mortality returns derived from the Registrar-General's report for London for twenty-five years showing 3898 deaths from carbuncle in men and 1549 in women. Concerning the relative frequency of neoplasms in the sexes, it may be stated that the liability of females is more than twice that of males. Of the 11,000 cases tabulated by Williams,[3] the percentage is 33 males to 67 females, this difference being due largely to the great frequency with which in females the breast, uterus, and ovary are attacked, the corresponding organs in the male seldom being affected. In females about 70 per cent. of all new growths attack the reproductive organs, whereas in males statistics show only about 7 per cent. Males are somewhat more prone to be attacked with sarcoma than females, but the difference is not great. Cancers occur more frequently in males than in females, the numbers given by Williams being 1398 males and 444 females, or 3.14 males to 1 female. While cancers in general are more common in males than in females (about 3 to 1), rodent ulcer is about equally distributed between the sexes.

Climate.—The influence of climate in the production of cutaneous disease cannot be questioned. Observations have established the fact that certain diseases are almost peculiar to certain countries; as examples, leprosy, elephantiasis, pellagra, frambœsia, and pinta may be mentioned. To what extent, however, climate alone is to be held accountable cannot be definitely ascertained; other agencies, as hygiene, diet, and the habits of the people, must also receive consideration as probably often having a share in the causation of the malady. Among climatic influences in the production of certain skin diseases, reference may be made to the effect of moisture, which in some regions where it abounds, as in the South Pacific Islands, is productive of the tineæ. The action of high temperature, as in equatorial and subtropical countries, causing increased secretion of sweat and consequent disease, as miliaria and the like, is well known. The influence of the sun and of the wind must also be referred to. Herpes zoster is at times due to certain peculiar climatic or local influences, as shown by the occurrence of small epidemics in communities. Erythema multiforme, erythema nodosum, and other diseases may appear under similar influences. Thus, Gifford Nash[1] reports an instance where there occurred in one family within a period of ten months four cases of erythema nodosum. Here there was probably some unknown local cause which produced the disease.

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[1] See The Influence of Sex in Disease, by W. Roger Williams. London, 1885.

[2] Loc. cit., p. 9.

[3] Loc. cit., p. 15.

VARIATIONS IN PREVALENCE AND TYPE.

Under this head the variations in the prevalence and in the type of diseases as encountered in different countries may be referred to. Statistics show that some diseases are much more common in some countries than in others. According to J. C. White,[2] tinea favosa is less frequently met with in the United States than in Europe, especially in Scotland. In Italy, according to general statistics, it is one of the common affections of the skin. On the other hand, tinea tonsurans and tinea versicolor are of infrequent occurrence in that country. In the United States lupus is much rarer than in Europe, while leprosy is met with only occasionally, and usually as an imported disease. Affections of the glandular system, especially those intimately connected with the nervous system, are of more frequent occurrence in the United States than in Europe. The subject of skin diseases in America was discussed by J. Nevins Hyde before the Dermatological Congress held in Paris in 1889.[3] My personal observations derived from travel show that even in the different parts of one country variations in the kind and type of certain diseases are met with, dependent not only upon climate, but also upon race and population, hygiene, food, and mode of life.

It is well known that immigrants upon landing not infrequently manifest varied and sometimes peculiar forms of cutaneous disturbance, for the most part inflammatory in nature. As J. C. White[4] has shown, the diseases of the skin in these cases are probably due to several factors, the causes being connected not only with climate, but also with mode of life, food, and the state of the nervous system induced by the new experience.

Seasons.—The seasons exert a marked influence upon many of the inflammatory affections, as well as upon those of other classes, as, for example, the corneous epithelial hypertrophies. The majority of the superficial diseases are aggravated by cold weather, as is commonly observed in eczema, psoriasis, and ichthyosis. Pruritus hiemalis, as its name implies, is encountered only during cold weather. Other disorders, again, occur chiefly during the hot months, as, for instance, prickly heat; while still others incline to appear more commonly during the spring and autumn, as erythema multiforme.

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[1] Lancet, July 7, 1894.

[2] Variations in Type and in Prevalence of Diseases of the Skin in Different Countries of Equal Civilization. Proceedings International Medical Congress, Philadelphia, 1876.

[3] See Transactions, and also Jour. Cut. and Gen.-Urin. Dis., 1889, p. 438.

[4] Immigrant Dermatoses, Jour. of Cut. and Gen.-Urin. Dis., Oct. 1890.

Diathesis.—There has been much confusion and question among medical men generally as to the meaning of the word DIATHESIS. Some contend that it is capable of being clearly defined, and is expressive of a definite, recognizable state of the constitution, while others are of opinion that it is vague in meaning, and that it can occupy no scientific place in medicine. In the author's opinion, much depends upon the definition of the term and the sense in which it is employed. Jonathan Hutchinson[1] has discussed the subject with ability from a practical standpoint, and I am in accord with his views when he defines diathesis to be "any condition of prolonged peculiarity of health giving proclivity to definite forms of disease." It is a persisting morbid proclivity, and comprises groups of diseases different in their nature. There is a marked difference between a diathesis and a dyscrasia; as Hutchinson remarks, the specific animal poisons cannot become producers of diatheses, and should be regarded rather as dyscrasiæ. The author is also disposed to agree with Billroth,[2] who, in discussing the advisability of retaining the use of such words as diathesis, says, "It will do no injury to science if we continue to use expressions in the accepted sense. It is still convenient to have a designation for these things, since the latter are not imaginary, but are founded upon observations verified during centuries, although the interpretation has become variously changed in form in the course of time."

Temperament.—Following the views of Halle[3] and Bradley,[4] temperament may be defined as constituting certain differences between men and men *compatible with health*, and consisting of differences in the relative proportions of certain parts of the organism which thereby exercise a preponderating influence upon functions of the economy. Diatheses, on the other hand, signify such hereditary and innate constitutional conditions as may lead to the outbreak of some local or general disease peculiar to the diathesis. As Bradley states, it may be objected that this use of the words temperament and diathesis is too arbitrary; but while this is true to a certain extent, the terms have distinct practical advantages if the ideas are not carried to extremes. Temperament has been defined by Jonathan Hutchinson as "the sum of the physical peculiarities of an individual, exclusive of all definite tendencies to disease." It is a physiological condition, and is not the result of influences to which the individual has been exposed during his life. Laycock,[1] who gave the subject careful study, views the subject from a similar stand-point.

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[1] Pedigree of Disease, p. 60. London, 1884.

[2] Lectures on Surgical Pathology and Treatment, New Syd. Soc. Trans., vol. ii. p. 104. London, 1878.

[3] Dict. des Sci. Méd., tome liv. p. 460.

[4] Injuries and Diseases of the Lymphatic System, p. 118. London, 1879.

Race.—The influence of race in the production of disease of the skin may be referred to. The colored races exhibit a greater tendency than the white races to the formation of growths containing fibrous tissue, due to proliferation of cells around the capillaries, constituting true inflammatory sclerosis, as occur strikingly in elephantiasis and keloid, and also in uterine myoma, the three diseases most characteristic of dark-skinned races. Among the malignant neoplasms the connective-tissue type predominates in the colored races. These peculiarities, as E. A. Balloch[2] states, constitute a pathological law not heretofore sufficiently recognized.

Complexion.—The natural complexion also asserts its influence in the causation of disease. Blonds, with light hair and eyes and thin skin, are more prone to glandular disorders and to degeneration of the epithelial structures than dark-haired and swarthy individuals. The latter are more ready to develop pigmentary affections, simple and degenerative, and also connective-tissue growths, especially hypertrophies, as elephantiasis, fibroma, and keloid.

Natural irritability of skin is sometimes present in individuals in a marked degree, as evidenced by the ease with which some skins show irritation from the ingestion of certain articles of food, drugs, and especially local irritants, as woollen clothing, vegetable and mineral poisons, and the bites and stings of various insects. This happens not infrequently, and often without an idiosyncrasy existing.

Predisposition.—By this term is meant a peculiar, inherent state of the constitution which inclines to the ready development of some one disease. The existence of this state of the economy is not uncommon. The tendency may exhibit itself in one, or, as is often the case, in several or all of the members of a family. It may be inherited, or it may originate with the individual. Thus, it is a matter of frequent observation that certain families manifest more or less of a disposition to the development, under favorable conditions, of some of the commoner forms of disease, especially those of an inflammatory character, as, for example, eczema, and also the keratoses. An hereditary predisposition to the formation of blebs as the result of any mechanical injury to the skin, occurring in most instances in several members of a family, is occasionally noted. Köbner,[3] Max Joseph,[4] Lesser,[5] and others, have reported cases where the slightest pressure, and even the contact of the clothing, under ordinary circumstances and at all times caused blebs to form.

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[1] Lectures on Temperament, Med. Times and Gazette, 1861.

[2] Medical News, Jan. 18, 1895.

[3] Hereditäre Anlage zur Blasenbildung (epidermolysis bullosa hereditaria), in Deutsch. Med. Wochenschr., No. 2, 1886.

[4] Monatsh. f. prak. Derm., Bd. v. No. 1, 1886.

[5] Monatsh. f. prak. Derm., Bd. xv. (1892), S. 571. Among the first cases reported were those of Valentin and of Goldscheider. F. Hebra in his work on diseases of the skin described this condition as "congenital pemphigus."

Idiosyncrasy.—This plays a part in the production of certain cutaneous as well as other diseases. We recognize the results produced, but are ignorant of the causes which occasion this condition. It is a peculiarity of the constitution or organization, usually but not always congenital, characterized by a definite but variable extreme degree of susceptibility to certain influences. The most striking examples of idiosyncrasy in the production of cutaneous manifestations are seen as the results of the ingestion of certain articles of food and drugs. The whole subject is extensive, and is worthy of attentive consideration in all its aspects by both the patient and the physician. The long list of the varied eruptions due to drugs furnishes innumerable instances, many of which are very striking and singular.

INTERNAL CAUSES.

In this division are to be classed all those causes originating internally, or of a constitutional nature, which are known to be able in any way, however remote, to give rise to disturbance or disease of the skin. They are numerous and call for profound investigation. At times they are very obscure and far removed in their seat from the skin; while, on the other hand, in some cases they are so commonplace as perhaps to be overlooked by the casual observer.

Heredity.—Some diseases are known to be hereditary; as common examples of which syphilis, ichthyosis and other keratoses, psoriasis, and eczema may be cited; but it must not be supposed that all or any of these diseases are in every instance hereditary. According to my experience, the two latter affections are perhaps more frequently found to be developed in the individual than to have a history of transmission from the parents. Ichthyosis, likewise, often originates with the individual so affected. In proof of the hereditability of some of the keratoses may be cited the historical and authenticated instance of the Lambert family, in which, beginning with the father, five generations, all sons, were similarly affected with ichthyosis hystrix. As Hutchinson[1] states, where there is defect in development of the skin, it is seldom restricted to one tissue. Those who have vascular nævi often have moles as well, and, it may be, several varieties of them. This observer[2] gives the case of a boy who was born without hair, and almost without subcutaneous fat, and with scars in the localities of the mammary glands. There were also other defects of the skin and its appendages, and of the nails and teeth. The condition seemed to be the result of complete alopecia in the mother, who was in other respects well developed.

Concerning heredity it may be said, that probably all observers will agree in the view that at least a weak constitution may be inherited. In such cases the power of the constitution to resist the invasion of the numerous causes (as, for example, bacteria) of disease is wanting. This weakness may be general, affecting the whole organism, or special, affecting certain organs or membranes, as the mucous membrane or the skin. Debility, which leads to other peculiar or unknown states of the tissues, is a potent factor of disease, the exciting causes, as bacteria, traumatism, and the like, being in perhaps most instances of secondary importance. The bacilli of certain diseases—as, for example, lupus—are, practically speaking, harmful only when they find a soil congenial for their growth. This condition, unfortunately, often exists, and is to a large extent in many cases inherited in the form of a weakness of some special organ, or more often of a set of organs, or of some tissue, as, for example, the epithelium. But such is not the case with certain other virulent infectious diseases, such, for example, as syphilis, whose contagium takes root and thrives upon and destroys strong as well as weak tissue. The agents which produce diseases of the latter kind are potent in all individuals irrespective of the condition of their tissues, though not to the same degree in all.

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[1] Archives of Surg., 1890-91, p. 256.

[2] Brit. Med. Jour., vol. ii., 1887, p. 231.

FAMILY DISEASES.

In connection with the subject of heredity the so-called FAMILY DISEASES may be referred to, in which several members of a family are similarly affected, the disease, however, not necessarily being hereditary. Examples of such diseases are found in xeroderma pigmentosum (Kaposi), xanthoma planum, sebaceous cyst, trichorrhexis nodosa, keratosis palmaris et plantaris, and ichthyosis. To this list may be added the hereditary tendency to bleb-formation, already referred to in considering the subject of predisposition to cutaneous disease.

There are, however, instances of disease occurring in several members of a family which are not entitled to be classed as family diseases, being due to peculiar local or climatic conditions, as, for example, in the erythema nodosum cases referred to in considering climate.

Constitutional Diseases.—These in many instances exert a positive influence upon the skin. At times the malady is of such a nature that its existence merely predisposes to some slight cutaneous disorder, such as chloasma or seborrhœa, as is the case, for example, in chlorosis; while in other instances, as in the exanthemata and in syphilis, it is of so virulent a nature that the eruption is but one of a number of prominent manifestations.

Malaria, the poison which finds its most typical expression in common fever and ague, must also be referred to as a factor in cutaneous medicine, as L. P. Yandall,[1] of Louisville, pointed out in an article before the American Dermatological Association, in 1877.

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[1] American Practitioner, January, 1878.

In this connection it may be observed that a depraved state of the general health, resulting from a variety of causes, may play a part in the causation of certain cutaneous affections. A recognition of this fact will frequently serve as a guide in the treatment. Thus, it is owing to a deterioration from the normal state of health of the individual, for example, that ecthyma, cachectic acne, and ill-conditioned excoriations often show themselves. The nature of this deterioration it is not necessary to consider here. Instances of this kind, especially ecthyma, are frequently encountered in large hospitals and in almshouses, but are rarely met with in private practice.

Disorders of Internal Organs.—Here may be mentioned a number of functional and organic diseases capable, under peculiar conditions, of causing marked cutaneous manifestations. They may act through direct irritation, reflexly, or indirectly by impairing cutaneous nutrition. Thus, acute and chronic derangement of the alimentary canal is a productive source of a number of complaints, among which eczema, urticaria, and acne stand forth as prominent examples. The relation of certain diseases of the skin to disturbances of the digestive tract has been closely inquired into by A. Pick,[1] who regards it as probable that in the alimentary tract of those individuals in whom the ingestion of certain articles of food gives rise to urticaria, ferments occur which form poisons out of substances contained in these foods. A case is related in which an attack of urticaria always followed the use of potatoes and preserved fruit, and which could be prevented by the administration of small doses of creosote. Affections of the kidney, as Bright's disease, albuminuria, and diabetes, occasionally give rise to œdema, to pruritus, and more rarely to eczema. Diseases of the liver are known to occasion discolorations, as jaundice, and also to cause pruritus. Uterine diseases are likewise recognized as frequently causing pigmentary disturbances, urticaria, eczema, and other cutaneous manifestations. Finally, derangement of the nervous system is, as is well recognized, capable of giving rise to a variety of disorders of the skin; thus, eczema, herpes, urticaria, pruritus, and alopecia, also certain hypertrophies and atrophies, may be referred to as being not infrequently caused and influenced by both functional and organic disease of the nervous system.

Some of these topics may be specially referred to.

KIDNEYS AND URINE.

That the urine is not infrequently disordered, as shown by chemical and microscopical analysis, in connection with various diseases involving the skin, especially with those of an inflammatory nature, is well known. How far the abnormal secretion in some cases can be regarded as a cause of such disease is a question difficult to decide. In many instances it seems likely that the excretory product of the kidneys, of whatsoever nature, is the result of elimination of deleterious substances from the system analogous to that taking place from the diseased skin. Both are excretory organs. In this connection the important supplementary relation of the kidneys to the skin in health and in disease generally must be kept in mind. That abnormal urine should in some cases be present in such cutaneous diseases as generalized eczema involving the greater part or the whole of the skin, dermatitis exfoliativa, and the like, does not seem remarkable. Diabetes is sometimes associated with boils, carbuncles, gangrene, eczema, erythema, urticaria, pruritus, and also with that form of xanthoma known as xanthoma diabeticorum. The relation of the kidneys and the urine to various diseases of the skin has been investigated particularly by Bulkley,[1] of New York, Thibierge,[2] of Paris, and Gamberini,[3] of Italy, all of whom bring forward important observations showing that in some cases an intimate relationship exists. S. West[4] has also reported cases of acute affections of the skin in the course of kidney disease.

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[1] Wiener Med. Presse, No. 31, 1893.

GOUT AND RHEUMATISM.

The lithæmic, or gouty, state frequently causes manifestations of disease upon the skin. It influences the general behavior of various cutaneous diseases. Such diseases as the erythemata, eczema, and psoriasis are in some individuals distinctly gouty, sometimes alternating in their manifestations with gout in other tissues or organs. The skin is to be viewed as one of the emunctory organs of the body, and as such it assumes a share in the elimination of deleterious products, often thereby becoming irritated and diseased in one form or another. In this sense, therefore, gout, characterized by an altered state of the blood, due to defective excretion, may be looked upon as a cause of certain diseases, especially those of an inflammatory nature. It is an irritant to the tissues. The altered urine, more or less loaded with oxalate of lime, urates, and uric acid, is the usual index to this condition. It is indicative of the peculiar changes that have taken place in the blood. It must be kept in mind that the skin is an organ of excretion as well as are the kidneys, and that the two sets of organs are closely correlated, and supplement each other in such work as the elimination of effete products.

The relation of certain skin diseases to rheumatism has long been established. The erythemata, both superficial and deep-seated, are often preceded and accompanied with rheumatic aching and pain. Erythema papulosum is the commonest form met with, but erythema nodosum, scarlatinaform dermatitis, and purpura are also not uncommon. Sometimes such eruptions accompany acute articular rheumatism; in other cases the rheumatic symptoms are secondary to the cutaneous manifestation. They seem in most cases to depend upon a general vitiated state of the system, due to disorders of the circulation arising from various causes.

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[1] Archives of Derm., Oct., 1875.

[2] Des relations des dermatoses avec les affections des reins et l'albuminurie, Annales de Derm. et de Syph., 1885, 2 sér. vi. p. 424.

[3] Abst. in Monatshefte f. prak. Derm., 1884, p. 813.

[4] St. Barth. Hosp. Rep., 1886, xxii. p. 226.

RESPIRATORY SYSTEM.

The relation of the respiratory system, more especially nervous affections of the same, to certain cutaneous affections, is occasionally made manifest in such diseases as eczema, psoriasis, and urticaria, which may be closely associated with spasmodic asthma. L. D. Bulkley[1] has discussed the subject, with corroborative instances from practice, and Hölscher[2] gives the notes of four cases in which psoriasis and asthma occurred conjointly. In some cases asthma appeared with the eruption of psoriasis and ceased as the latter vanished; in other cases the asthma preceded the psoriasis and disappeared as the eruption developed.

Varied cutaneous affections are also known to accompany or to follow influenza, or "the grip," in some cases, the most common perhaps being the polymorphous erythemata, which are often morbilliform in character. Herpes, purpura, urticaria, eczema, and other manifestations[3] have also been observed.

SEXUAL SYSTEM.

It is well known that irritating influences existing about the reproductive organs of either sex are capable of provoking such diseases as the erythemata, urticaria, herpes, acne, and various forms of pigmentation. Thus, urethral irritation in the male has been shown to be the cause of acne in some cases, and disordered menstruation may give rise to the same disease. The eruptions occurring in the course of gonorrhœa may also be referred to. The latter are polymorphic in character, for the most part scarlatinaform and morbilliform, and possess no specific character by which they can be distinguished from the erythemata due to other causes.[4]

The influence of the sexual system in the production of cutaneous disease is a factor of sufficient importance to be worthy of attentive consideration.[5] The alterations which occur in the skin at puberty are such as to cause circulatory disorder, and glandular disturbances in particular, as seen in comedo, acne, seborrhœa, and hyperæmia or anæmia. The influence of menstruation and of pathological conditions of the uterus in cutaneous diseases is well known. The relations of the skin to the uterus at the menstrual epoch and at the menopause are probably intimately connected with blood-pressure. This would seem to be especially true in the case of purpura, the skin in most cases, especially if weak, offering the least resistance to increased blood-pressure. The eruptions of menstruation are varied, but are for the most part inflammatory and neurotic, herpes of the face, lips, and genitalia being one of the commonest manifestations. The subject of menstrual herpes has been specially investigated by Bergh,[1] of Copenhagen, who states that it is not due to local irritation, but that the nervous system is at fault, a view shared by the author. Eczema, acne, and hyperidrosis (usually localized) are encountered. Bullous and pemphigoid lesions are also occasionally met with. Thus, Hardy[2] has applied the term "pemphigus virginum" to a bullous eruption characterized by the successive appearance of blebs extending over several months, occurring in young women the subjects of interrupted menstruation. Anomalous forms of eruption are not rare, in some cases in connection with normal menstruation, in others with uterine disease of one kind or another. The subject has been elaborated particularly by L. Grellety.[3] Alterations of the skin at puberty and at the menopause have also been studied by Deligny.[4]

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[1] Brit. Med. Jour., Nov. 21, 1885.

[2] Monats. für prak. Derm., Bd. xvii., No. 9.

[3] See, for further information, articles by Barthélemy, abstract in Jour. Cut. and Gen.-Urin. Dis., 1890, p. 279, and Schwimmer, abstract in Lond. Med. Rec., Sept. 20, 1890.

[4] For further information, see an article by Léon Perrin, in Annales de Derm. et de Syph., Nov. 1890.

[5] For further information, see an article by the author and M. B. Hartzell, in Keating and Coe's "Cyclopædia of Diseases of Women," Phila., 1895; also a paper by G. H. Rohé, in Buffalo Med. and Surg. Journ., Feb. 1889.

The puerperal state is sometimes a distinct factor in the production of cutaneous manifestations, among the more striking of which may be mentioned erythema scarlatiniforme,[5] impetigo herpetiformis, and dermatitis herpetiformis, more especially the vesicular and bullous varieties of the latter disease (the so-called "herpes gestationis" of some writers). Most of the graver eruptions are probably toxic or septicæmic in origin.

Functional disturbance or structural lesions of the sexual organs in the male must also be referred to as a factor, as observed in progenital herpes, acne, comedo, and other affections. At times the relation between the skin and the reproductive organs in either sex is obscure, but the success in some cases which follows appropriate treatment proves the correctness of the general observation.

NERVOUS SYSTEM.

The relation of the nervous system to disease of the skin is an important subject, covering a broad field. Close observation shows plainly the influence which the nervous centres, the nerve trunks, and the peripheral endings possess over various and diverse cutaneous manifestations. A great deal has been written latterly on the subject by such able authors as S. Weir Mitchell,[1] Bulkley,[2] Leloir,[3] Arnozan,[4] Schwimmer,[5] Erb,[6] Crocker,[7] and Kopp,[8] and the information has been collected and classified. The subject is capable of still further elaboration, and the author's experience warrants the opinion that this group of diseases—the "neuropathic dermatoses"—will continue to grow and in the future to hold even a more conspicuous place in etiology than at present. The subject is continually assuming greater proportions.

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[1] Abst. in Jour. de Mal. Cut. et Syph , No. 6, 1891.

[2] Les Maladies de la Peau. Paris, 1886.

[3] Influence of Menstruation and of the Pathological Conditions of the Uterus in Cutaneous Diseases. Translation in Wood's Med. and Surg. Monographs, vol. iii., No. 1, July, 1889.

[4] Jour. Cut. and Gen.-Urin. Dis., 1888, p. 315.

[5] Whipham has recorded cases of this kind in Clin. Soc. Trans., vol. xvi.

The many cutaneous diseases which have been shown to be directly under the influence of the nervous system are extremely diverse as regards the lesions manifested, hyperæmic, inflammatory, and atrophic affections all being common. Among the inflammations, all the primary lesions may be produced, singly or in various combinations, through its influence. The effects of the nervous system upon the integument, therefore, are extremely variable. While the nervous system is a powerful factor in the etiology of skin diseases, its action in the production of symptoms is often uncertain. A variety of lesions may be produced by the same nerve disorder or disease.

The subject may be considered under the heads of disease of the skin accompanying or following cerebral disease; disease of the spinal cord; disease of the sympathetic; peripheral injuries and wounds of nerves; and lesions of nerves supplying diseased skin. Eruptions due to disease of the cord are numerous, especially in connection with locomotor ataxia, such as erythema, erythema nodosum, urticaria, zoster, pemphigus, ulcers, and gangrene. The posterior columns play an important part in the nutrition of the skin, and consequently impairment of their function may be followed by various cutaneous lesions. Spinal meningitis may be accompanied with erythematous, vesicular, and bullous eruptions. Such conditions as hyperæmia and anæmia of the skin, pigmentation, and sweating are sometimes traceable to lesions of the sympathetic. Lesions due to peripheral injuries of nerves are more common, and the same may be said of disease of nerves supplying the skin, a striking example of which occurs in herpes zoster. Multiple neuritis is a well-known cause of varied peripheral neuroses characterized by sensory disturbances, as pain, numbness, loss of sensation, and by various vasomotor disturbances, hyperæmia, inflammation, atrophy, paralysis. The skin suffers together with the deeper structures, as shown by varied hyperæmic, inflammatory, and atrophic manifestations, for the most part peculiar in that they possess a NEURITIC ASPECT. Pigment changes in the skin and hair are not infrequently met with as the result of some mental state, as, for example, in sudden blanching of the hair, and in vitiligo, in epileptics, and in the insane. Eruptions of one kind or another, especially blebs, are also met with in general paralytics.

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[1] Injuries of Nerves and their Consequences. Phila., 1872.

[2] Archives of Electrology and Neurology, Nov. 1874.

[3] Recherches cliniques et anatomo-pathologiques sur les affections cutanées d'origine nerveuse. Paris, 1881.

[4] Lésions trophiques consécutives aux Maladies du Système nerveux. Paris, 1880.

[5] Die neuropathischen Dermatonosen. Wien, 1888.

[6] Diseases of the Peripheral Cerebro-Spinal Nerves, Ziemssen's Cyclopædia of Pract. Medicine. New York, 1876.

[7] Brain, vol. vii., Oct. 1884, p. 345.

[8] Die Trophoneurosen der Haut. Wien, 1886.

The influence of the great sympathetic system of nerves in the production of manifestations upon the skin is extensive and potent. The subject has been elaborated by three authors in particular, Eulenburg and Guttmann,[1] C. V. Chapin,[2] and Edward Long Fox,[3] in whose writings the reader will find much of interest pertaining to the subject.

The influence of the nervous system in the causation of skin diseases is positive, and is exerted in many ways. The effect of the mind on the body is at times a potent factor in the production of both functional and structural disease. The brain and the skin are ever in the closest touch. The influence of the mind in the etiology of cutaneous diseases has been shown by the reports of numerous well-authenticated cases. Mental shock, suddenly impressing the nervous centres, fright, nervous strain, worry, excitement, fear, grief, and anger, may all provoke cutaneous disorder. Shock is a well-recognized cause of numerous functional and structural cutaneous diseases, of which hyperidrosis, change of color and other alterations of the hair, alopecia areata, pemphigus, and dermatitis herpetiformis sometimes serve as striking examples. The influence of the mind on the body may be exerted in many ways, as has been shown by observers in numerous well-authenticated cases. The influence may be injurious or beneficial, the former occurring most frequently and strikingly. But beneficial results also follow such influence, as is occasionally observed in what are generally designated by the laity as "faith-cures." This topic has been carefully investigated from a surgical point of view by J. William White,[4] who concludes, in his article on "the supposed curative effect of operations *per se*," based on an extensive literature, that "there are large numbers of cases of different grades of severity and varying character which *seem* to be benefited by operation alone, some of them by almost any operation."

PSYCHICAL STATES AND SHOCK.

It is well known that the emotions, in particular fright, grief, and anxiety, have a positive influence in the production of varied cutaneous diseases, more especially those of an inflammatory, hypertrophic, and atrophic nature. Many authentic instances of cases are on record.

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[1] Physiology and Pathology of the Sympathetic System of Nerves: translated from the German by A. Napier. London, 1879.

[2] The Sympathetic Nerve: its Relations to Disease. Fisk Fund Prize Essay, 1880. Providence, 1881.

[3] Influence of the Sympathetic in Disease London, 1885.

[4] Annals of Surgery, Aug. and Sept. 1891.

Leloir[1] saw a case of polymorphous bullous erythema in a woman suddenly follow a violent attack of anger, and R. W. Taylor[2] records a case of erythematous eczema which appeared on a healthy woman immediately after hearing of the sudden death of her husband. Tommasoli,[3] of Italy, has also brought forward cases to emphasize the subject. He cites the case of a young woman who was suddenly attacked with a pemphigoid eruption immediately after receiving the tidings of the death of her husband; also another case of a lady who was afflicted with eczema of the eyelids, neck, arms, and vulva very soon after hearing the sad tidings that her daughter had committed suicide; and a third case of a man who, being threatened with personal injury by a debtor whom he had importuned for payment, was greatly frightened, and was almost instantly seized with acute dermatitis accompanied with a pustular eruption covering the back and the extremities. Such and similar causes, though rare, are now generally recognized. Diday and Doyon[4] lay considerable stress upon mental shock as a factor of cutaneous disease, and give cases of psoriasis, lichen, and other superficial inflammations due to such causes. F. Mayer[5] also refers to many well-authenticated cases.

Cases are occasionally met with where it is difficult to determine whether the cause is psychical or physical, or a combination of the two, as in a severe case of dermatitis herpetiformis with vesicles and blebs reported by me,[6] occurring in a strong man very shortly after an accident which exposed him to the fear of imminent death and to physical exhaustion for many hours. I am of opinion, however, that in almost all these cases the chief if not the sole factor is mental shock. Not only may the skin proper be affected, but in like manner the appendages of the skin, as in a case of loss of both the hair and nails from fright recorded by Foley.[7] A number of cases illustrative of the subject are on record.

MENTAL IMPRESSIONS UPON THE FŒTUS.

As already stated, the part that the mind or the impressionable nervous matter of the body plays in the production of cutaneous disease is at times positive. The influence of the mind upon the body is, under certain conditions, powerful. As part of the body the integument thrives and suffers with the other organs which go to make up the whole economy. Striking instances of the mind influencing the skin structurally are observed in the so-called MATERNAL IMPRESSIONS UPON THE FŒTUS, the resulting effects being extremely variable, in some cases slight, in others grave, while occasionally they are extraordinary. The commoner forms are pigmentary and vascular nævi, with all manner of intermediate clinical and pathological formations. That such defective or altered normal tissue and growths are due to the direct influence of the maternal mind upon the nutrition of the fœtus, and upon certain structures in particular, admits of no question. This subject has been discussed fully and ably by many eminent in the profession, among whom may be mentioned Fordyce Barker,[1] S. C. Busey,[2] J. W. Ballantyne,[3] W. C. Dabney,[4] and Arthur Mitchell,[5] all of whom bring forward personal observations in substantiation of the occurrence, and my own experience is also corroborative. Barker comes to the conclusion that all who disbelieve in the doctrine base their scepticism on what they regard as physiological reasoning, and mainly on the assertion that there is no direct nerve communication between the maternal and the fœtal system, and that therefore impressions made upon the mother cannot be transmitted to the fœtus. The same observer thinks that the term maternal impressions should not be restricted to emotional causes alone, but should include those that have a physical as well as those that have a psychical origin. He cites five convincing cases from his own practice. Busey reports forty-one collected cases, and Mitchell records six cases.[6]

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[1] Des Dermatoses par choc moral. Paris, 1887.

[2] Recorded in J. William White's article in Annals of Surgery, Aug. and Sept. 1891.

[3] Abstract in Med. Record, vol. i., 1887.

[4] Thérapeutique des maladies vénériennes et cutanées. Paris, 1876.

[5] De l'influence des emotions morales sur le développement des affections cutanées. Paris, 1876.

[6] Amer. Jour. of the Med. Sci., Jan. 1885.

[7] Boston Med. and Surg. Jour., Sept. 29, 1887, p. 302.

HYSTERIA.

The so-called "hysterical diseases of the skin" show themselves with varied lesions, and are mostly obscure in their pathology beyond the observation that they have an hysterical foundation. In this group may be placed such cases as the author has reported under the heading of "neurotraumatic dermatitis vesiculosa et bullosa,"[7] and Kaposi,[8] under the title "zoster gangrænosus recidivus atypicus hystericus," and the like. A remarkable example of hysterical cutaneous disease in the form of a circumscribed, bulky, epithelial crust of long standing, has been recorded by S. Weir Mitchell,[9] through whom I had the opportunity of studying the case.

H. Leloir[10] divides this whole subject as follows: (1) DERMATONEUROSES CUM MATERIA, these being neurotic affections of the skin secondary to visible anatomical lesions of the central or peripheral nervous system; and (2) DERMATONEUROSES SINE MATERIA, embracing the cutaneous disturbances and diseased states and their modifications, proceeding from functional disorders of the central or peripheral nervous system, but where no visible anatomical lesion has been proved up to the date of the observation. To the first division belong (*a*) diseases due to primitive peripheric nervous lesions; (*b*) due to ganglionic lesions; (*c*) due to central lesions produced by peripheric nervous alterations; (*d*) due to primitive central lesions; (*e*) due to lesions of the great sympathetic.

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[1] Amer. Gyn. Soc. Trans., vol. xi. [2] Ibid.

[3] Edinburgh Med. Jour., Jan. 1891.

[4] Cyclop. Dis. of Children, edited by Keating, vol. i. p. 191.

[5] Trans. Lond. Obstet. Soc., vol. xxvi.

[6] Among other authors who believe in the potency of maternal impressions may be mentioned Geoffroy St.-Hilaire, Montgomery (Signs and Symptoms of Pregnancy, 1856, pp. 17-22), Martin St.-Auge, Hammond, and Allen Thomson (Cyclop. Anat. and Physiol., vol. ii.).

[7] Internat. Med. Mag., March, 1892.

[8] Archiv für Derm. u. Syph., 1886, p. 179, and 1890, p. 885.

[9] Amer. Jour. Med. Sci., March, 1893. With chromo-lithograph.

[10] The subject has received careful consideration from this author, to whose works the

To the second division belong (*a*) diseases due to functional disturbances of the peripheral nerves, as the endings, filaments, branches, trunks, or plexuses of nerves; (*b*) due to functional disorder of the nervous ganglia; (*c*) due to functional disturbance in the nervous centres determined by peripheral nervous irritations, spinal or encephalic in origin (properly called REFLEX DERMATOSES), and (*d*) due to functional disturbance in the primitive nervous centres, as the psychical and emotional dermatoses and the like.

Food.—Food is accountable for a number of diseases. Improper quantity, whether too much or too little, and unsuitable quality, are both to be regarded as conspicuous factors in the causation of diseases of the most diverse nature. To keep the economy in a state of perfect equilibrium it is essential that the proper amount and kind of nutriment be taken into the system. Many diseases affecting the integument are without doubt indirectly and directly due to insufficient food and improper diet, viewing the subject in its broadest sense. In support of this view, one has but to glance at the clinics of hospitals and dispensaries and note the poor nutrition and general health, and inquire into the average usual diet of the subjects of these disorders.

Certain kinds of food are particularly liable to occasion cutaneous disturbance. Shell-fish, for example, is in some individuals sufficient to call forth urticaria every time it is indulged in. Some fruits, especially strawberries, are at times followed by the same disease or erythema. Oatmeal and buckwheat are also known to occasion an erythema or a pruritus in some individuals. The injurious effects of wine and beer, and of indigestible articles of food, as cheese, pickles, spices, pastry, and the like, are frequently seen in eczema, urticaria, acne, and other diseases. Alcohol in many instances proves distinctly harmful, and numerous cases might be presented illustrative of its baneful influence upon the skin, especially in the inflammatory dermatoses.[1] The cause in the matter of

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reader is referred for further information. See "Trophonévrose" in Dictionnaire de Jaccoud, 1884, p. 103, and Annales de Derm. et de Syph., 1886, p. 782; also, Recherches cliniques et anatomo-pathologiquées sur les affections cutanées d'origine nerveuse. Paris, 1881.

[1] See an essay by H. Janin, De l'influence de alcoolisme sur le développement et l'evolution des affections cutanées. Paris, 1881.

food is probably always toxic, acting, by absorption of the poison, upon the nervous system, as in the case of drugs. Ample latitude, it need not be said, must be granted in the consideration of this subject, for what generally or invariably proves injurious or poisonous to one is often a useful food for another.

Medicine.—The ingestion of certain drugs used as medicine is at times productive of much damage to the skin; striking instances are observed in the erythematous or urticarial eruption not infrequently following the administration of copaiba and of cubebs, and the erythemata from quinine, chloral, belladonna, and morphine. Arsenic is a potent source of cutaneous disturbance, through the nerves governing nutrition, and in particular of pigmentation. Bromide and iodide of potassium are well known to produce not infrequently peculiar and often severe forms of cutaneous disturbance. The list of drugs capable of producing cutaneous disorder is so lengthy and the subject so important that a special chapter is devoted to the subject. Quinquaud[1] found by experiment that the ingestion of uric acid caused various primary lesions of the skin both in man and in animals, but that it did not produce any of the recognized so-called skin diseases. In eczematous subjects the itching was increased by the use of uric acid.

Pregnancy.—This state is not infrequently noted to exert a decided influence upon the skin, which is usually, but not always, injurious. Not infrequently it is observed to occasion attacks of eczema, herpes, and pruritus, which disappear in most cases immediately upon the removal of the cause. Chloasma is likewise frequently observed as an accompaniment of pregnancy. On the other hand, chronic affections, as eczema and psoriasis, are often observed to be better during this period. The period of lactation may also influence the course of some diseases, as eczema, psoriasis, and disorders of the sebaceous glands. Some women suffering with chronic diseases of this kind are sometimes better than usual, or even free, during this time; others are worse, the latter being the more common experience.

Dentition, Vaccination.—Dentition may be regarded as an exciting cause of cutaneous disorder. Its importance viewed etiologically, however, is secondary, and should not be over-estimated. That both eczema and urticaria may be aggravated during the eruption of the teeth is generally recognized. In addition to the usual local disturbance which vaccination occasions, it is now and then followed by peculiar erythematous, pustular, or furuncular affections. Such occurrences are comparatively rare, and usually are benign in their nature. Occasionally, however, the lesions are deep-seated and complicated, and the disturbance severe, giving rise to considerable inflammation of the skin and subcutaneous tissue, variable as to form, and to marked systemic disturbance. Toxic and septic infections are doubtless the factors in most of these cases. The subject is more fully considered in the chapter devoted to vaccinal eruptions.

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[1] Lond. Med. Recorder, Sept. 20, 1890.

EXTERNAL CAUSES.

The causes of this nature are numerous. Many of them are to be viewed as exciting causes, giving rise to disorder only under peculiar conditions, or in those cases where there exists a predisposition to the disease manifesting itself. Others, however, at all times and upon all subjects act injuriously upon the skin, and are the direct source of the disturbance. To this class belong mechanical injuries, irritation, friction, poisons, and many other agents.

Occupation.—Certain occupations are known to be productive of harm to the skin, giving rise to hyperæmia, inflammation, or hypertrophy. Thus, workers in chemicals, as acids and alkalies, and in dye-stuffs, especially aniline products and arsenic, are liable to suffer from the irritating substances with which they come in contact. Washerwomen exposed to the long-continued influence of water and strong soap, and masons, may also be referred to as being liable to rough or harsh skins and fissures, dermatitis, or eczema. Machinists, carpenters, shoemakers, and others who make constant use of tools, are ordinarily the subjects of more or less epithelial hypertrophy upon the hands, in the form of callosities.

The influence of occupation in the production of cutaneous disease of one kind or another is, in fact, of considerable importance. The subject has been investigated in a thorough manner by J. L. Foley.[1] In addition to the instances above cited, exposure to wind and weather causes thickening of the corium, and a tendency to rosacea and erythematous affections, as seen in policemen, sailors, soldiers, coachmen, and cabmen. The sedentary life of the student tends to dyspepsia and consequent acne and eczema. The agricultural class are liable to erythema calorica, dermatitis venenata, and the ravages of the leptus. Toy-makers are liable to arsenical eruptions; gilders, to eczema and alopecia from mercurial absorption; flax-workers, to dermatitis and acne; butchers and wool-sorters, to poison wounds, various pustules, and pustula maligna; while cooks, bakers, domestics, car-drivers, and typesetters, who are compelled to stand much, tend to develop varicosities, eczema, and leg ulcers.

Heat and Cold.—The extremes of heat and cold also act as causes in the production of disease; as examples of the former, erythema, dermatitis, and miliaria, resulting from continued exposure to a high temperature, may be mentioned. The action of the sun in calling forth several varieties of disease, as simple dermatitis and pigmentation, is well known. The influence of solar rays on the skin has been investigated by R. L. Bowles,[2] who concludes that heat in itself is not the cause of sunburn, but that the latter is due probably to reflected violet or ultra-violet rays of light; and, moreover, that rays from electric light produce much the same results as sun-rays reflected from snow. Cold acts in a similar manner to heat, as observed in frost-bite.

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[1] Jour. Cut. and Gen.-Urin. Dis., 1889, p. 170.

[2] Brit. Jour. of Derm., August, 1893.

Clothing.—Certain kinds of clothing, as well as unsuited modes of dress, must also be regarded as giving rise to hyperæmia and inflammation of the skin. The coarse flannel worn so persistently next to the skin by the working classes not infrequently serves as an exciting cause of erythema and of follicular inflammation. The injurious effects of such clothing in some cases are noted strikingly in the irritation, hyperæmia, and inflammation consequent upon wearing next to the skin harsh woollen, generally dyed, garments, to which, under the name of "vest-eruption," Hutchinson,[1] in particular, has directed attention. The influence of clothing on the skin has been investigated by J. L. Foley,[2] who points out that it is mainly the inner garments that provoke disease. Constant friction produced by ill-fitting articles of wear over tender portions of the body, as a stocking or shoe over the instep or about the heel, will often suffice to give rise to excoriations, ulcers, and other forms of disease, especially epithelial hypertrophies, as callosities, and the like.

Irritants.—Cutaneous irritants are the source of much mischief; for example, strong external remedies too freely used may prove causes of hyperæmia and inflammation. Among these, as most frequently occasioning disorder, sulphur, croton oil, the preparations of mercury, caustics in general, rubefacients, tartar emetic ointment, and tincture of arnica may be mentioned.

Uncleanliness.—Uncleanliness, or the presence of effete or foreign matter upon the surface, must likewise be considered as an exciting cause of disease, though in my opinion it is of less importance than is generally believed. On the other hand, too much attention to cleanliness may also be followed by an abnormal condition of the skin; the injudicious use of the bath and the constant use of strong soaps are hurtful to the welfare of the integument, and, moreover, favor contagion by injuring the epidermis. The frequency of the bath should be regulated by the condition of the skin, especially as to its natural secretions.

Scratching.—This operation brings about material and often extensive lesions upon the surface, especially in affections of an inflammatory and pruriginous character. It is noted to produce conspicuous lesions, however, chiefly in those cases in which the skin has previously become more or less altered by disease,—where primary lesions exist. Thus, in scabies, pediculosis, eczema, and ecthyma, scratching often creates a vast amount of local disturbance, greatly complicating the primary disease. In the disorders referred to it is, when protracted, the cause of structural changes in the skin, as manifested by excoriations, pigment alterations, and thickening. The condition of the skin as to its nutrition, the neuroses proper, and the presence of contagious elements, vegetable or animal, have much to do with scratching and its effects.

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[1] Archives of Surg., vol. ii., 1890-91.

[2] Montreal Med. Jour., 1890.

Traumatism.—The fact that eruptions of one kind or another sometimes follow injuries and wounds is well recognized, numerous cases of the kind being on record. The lesions in some cases are inflammatory, usually erythematous, vesicular, or bullous, in others atrophic, hypertrophic, or neoplastic. They may appear at the seat of injury or at one point or at several distant points.[1] To this category belong the so-called "surgical eruptions," those following operations, for the most part scarlatinaform in character, such as have been described at length by Kidd,[2] Stirling,[3] Hoffa,[4] and others. In some cases they are septicæmic in nature, and in others angio-neurotic.

Contagion.—Among the external causes the most important remains to be spoken of under this head. The varieties of contagion are numerous and exceedingly prolific sources of disease. Among the infectious diseases, those which are communicable through the medium of the atmosphere as well as contact, smallpox, measles, scarlatina, and erysipelas, occupy the most conspicuous place; while the contagious affections, strictly speaking, those which are transmissible through direct contact only, comprise especially syphilis, contagious impetigo, vaccinia, certain low forms of specific inflammation, as equinia, and the so-called parasites. Many of the cutaneous lesions of syphilis are contagious, and are active agents in the spread of this common malady in many ways other than through the genital organs. L. D. Bulkley[5] has directed attention in an important monograph to the numerous avenues in the walks of life through which an individual may innocently acquire this insidious disease. Lepra also may be acquired in ways that are often obscure and unfathomable in the light of the knowledge of to-day. It is much more insidious than syphilis in its invasion. Its initial lesion is unrecognizable and unknown.

The disorders occasioned by the animal and vegetable parasites of the skin form a distinct group; they are all contagious, although not equally so, some being at all times readily communicable, while others manifest their contagious properties only under certain conditions. Not all individuals, for example, are to the same extent susceptible to their harmful influence; two persons may, under like circumstances, be exposed to the same vegetable parasite, only one of whom will, in all probability, contract the affection. Some persons, as attendants in hospitals and others brought into frequent contact with the contagion, rarely if ever contract fungous diseases. The author is of opinion, therefore, that these parasites usually require a peculiar condition of the skin or soil for their growth and development. The commonest vegetable parasites (microscopic fungi) are the achorion Schönleinii, trichophyton and microsporon furfur. To the group of animal parasites belong the itch mite, head louse, body louse, and crab louse, together with several other insects of less importance, as the flea and bed-bug, which under favorable circumstances commit depredations upon the skin.

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[1] For further information consult the monograph of Picaud, "Des Eruptions cutanées consécutive aux lésions traumatiques." Paris, 1875.

[2] Lancet, 1868, i. p. 9.

[3] St. George's Hosp. Rep., 1879.

[4] Abst. in Lond. Med. Rec., Aug. 1887.

[5] Syphilis in the Innocent, New York, 1894.

DANGERS OF CONTAGION.

Danger of contagion is found in the animal parasites, more especially in the three forms of pediculosis and in scabies. The latter disease is often contracted by sleeping in the same bed with an affected person, and in many cases a history corroborative of this mode of contagion may be obtained. Of the vegetable parasites, ringworm, due to the trichophyton fungus, is that commonly met with, contracted usually by contact or through articles of the toilet or wearing apparel. The danger from tinea versicolor and tinea favosa is not so great, although the latter disease may be caught from the lower animals, especially mice and cats, and at times from the most casual exposure.

Among the rare diseases which man is liable to contract, anthrax, equinia, and actinomycosis, due to micro-organisms, may be mentioned, all derivable from the lower animals. Of the commoner diseases, syphilis, leprosy, and tuberculosis, likewise due to similar causes, remain to be referred to, all of which are insidious in their entrance into the system and are to be guarded against with every precaution. The physician is especially liable to contract syphilis in the discharge of his professional duties, particularly in midwifery, many cases of this most unfortunate accident having from time to time come to the notice of the author. He should always note whether his epidermis is everywhere intact before handling or even coming in mere contact with suspicious cases. Erysipelas, gonorrhœa, and diphtheria, as well as the acute infectious diseases generally, are all to be guarded against, as being diseases liable to be contracted through contagion and infection.

Contagion by contact may occur in many ways in the ordinary walks of life, prominent among which is the hazardous custom of handshaking (more prevalent in some countries than in others), whereby not only the itch but also other parasitic diseases may be communicated from one person to another. Kissing is a more dangerous act, for grave diseases (in particular syphilis and tuberculosis) may be readily conveyed in this way. The entrance into the system of such diseases through the skin and mucous membrane of the face is commoner than is generally believed.

The subject of the invasion of the skin by bacteria, micrococci, and other similar forms of microscopic organisms will be considered in the chapter on pathology.

GENERAL PATHOLOGY.

GENERAL OBSERVATIONS.

The pathology of the skin may be considered from several stand-points. A general view of the subject, especially as regards the results, in the form of tissue changes, of the several pathological processes, it seems to the author will be in keeping with the practical character of the rest of this work. The aim, therefore, will be to direct attention to the peculiar modes in which the skin is invaded by the various pathological processes concerned in producing diseases, and to point out the common morbid alterations in the structure of the skin which follow these processes. The latter topic constitutes the important department of pathological anatomy. It is upon these general lines that the classification in the present work rests.

The scheme is of distinctly practical value to the student of dermatology. It deals with the tangible aspect of the subject,—for the most part with anatomy and pathological anatomy. It regards the changes which have occurred in the skin—the so-called "diseases"—as of paramount importance for purposes of recognition and further study. It calls for a knowledge of the morbid changes which have taken place in the integument and in the several parts of which it is composed. It possesses the great advantage of resting securely upon the solid ground of anatomy. Upon this basis the pathology of the diseases is capable of being elaborated from every stand-point, including the important subject of etiological factors.

From a strictly practical point of view, what the practitioner desires to acquire, in order that he may relieve or cure the patient, is a knowledge of the aggregation of symptoms which go to make up the so-called disease, and of the meaning of the same. This knowledge is obtained by dealing primarily with the results of the process rather than with the causes which have produced it. An understanding of the latter should, of course, accompany the former, and, as already stated, is most important.

Etiology and pathology are closely related, each being more or less dependent upon the other. Hence they are to be studied and investigated together. The importance of acute observation in these two fields, so intimately related as they are, cannot be overstated. Bacteriology is able to demonstrate the etiology of many diseases; pathology informs us of the morbid processes which have been set up by bacteria and the like; while pathological anatomy deals with the structural changes that have been brought about by morbid processes. Bacteriology, moreover, has been the means of pointing out new and successful methods of treatment in cutaneous medicine. To view the pathology of the skin aright it must ever be kept in mind that dermatology is but a department of general medicine and surgery, and that for the understanding of morbid processes in the skin the observer must be familiar with general as well as local pathology.

METHOD OF STUDY.

The pathology of the skin is to be studied in the same light as that of other parts of the economy. The integument differs from other membranes chiefly in its anatomy, which on account of its complexity is subject to a variety of alterations, many of which are peculiar. It is liable to the same pathological processes, such as hyperæmia, inflammation, hypertrophy, and atrophy, as take place in other organs, and consequently is to be studied from the broad stand-point of general pathology. The morbid changes which occur in the skin are very numerous, and are moreover liable to varied modifications. To comprehend them correctly, a thorough knowledge of the normal structure is absolutely essential. A knowledge of the physiology of the skin is likewise important.

THE EPIDERMIS.

All portions of the integument, either separately or together, may be involved in the various diseases of the skin, but certain parts are more frequently invaded than others. The epidermis especially—partly in consequence of its serving as the external covering of the body and therefore being liable to a great variety of influences, partly because it is a very actively proliferating membrane or layer, and further because it is intimately associated with the deeper parts—is very frequently the seat of disease. From its position it necessarily plays a more or less prominent part in the pathology of all cutaneous manifestations. Its importance as a structure can scarcely be overestimated. Attention may here be directed to the anatomy of the epidermis, and especially to the fact that it is genetically a distinct layer. It is composed of two main strata, the corneous layer and the mucous layer. Of these the mucous layer, being the germ or living portion, is by far the more important, not only physiologically but also pathologically. Thus, in eczema, herpes, psoriasis, and many other superficial inflammatory dermatoses this layer is chiefly involved primarily, the manifest signs of vesiculation or desquamation being secondary to deeper-seated changes. Even in those instances in which the pathological process is situated exclusively in the deeper structures, it shows marked morbid changes, as atrophy or hypertrophy and its modifications, the result often of impaired nutrition. It is a common seat of hypertrophy in varied forms, as seen in callosity, cornu, wart, ichthyosis, and other keratoses. Various micro-organisms, including the common so-called vegetable parasites of the skin, also have their habitat here, the latter not infrequently taking complete possession of the corneous layer.

CORIUM AND SUBCUTANEOUS TISSUE.

In the corium and subcutaneous tissue, however, occur the greater number of morbid processes. The peculiar structure of these tissues, consisting of a close net-work of connective tissue, extensive plexuses of blood-vessels, lymphatics, and nerves, and a complete system of glandular apparatus, highly endowed with vascular and nervous systems, follicles, and hairs, renders them particularly liable to disorder. It is, moreover, through certain organs which have their seat in the integument, the sweat glands and sebaceous glands, that numerous effete products of the economy find their exit, some of which give rise to cutaneous disturbance. The hyperæmias or congestions all have their seat here; likewise that great class of diseases, the exudations or inflammations. Hemorrhages also occur here in both the papillary and the reticular layer, as observed in purpura. Many hypertrophies and atrophies and new growths of various kinds are seated mainly in the corium. The grosser parasites, especially the itch-mite, lice, and the bedbug, also prey upon this tissue. It is likewise in the corium that certain structural changes of the blood-vessels, lymphatics, muscles, and nerves take place, as found in angioma, lymphangioma, myoma, and neuroma. Functional disturbances of the cutaneous nerves, constituting the neuroses proper, manifest themselves in the papillary layer, a stratum well supplied with nerves, and in the mucous layer of the epidermis.

APPENDAGES OF THE SKIN.

The sebaceous and sweat glandular systems are attacked by functional disorders, as seborrhœa and hyperidrosis, and are the seat of varied structural alterations, either alone, as in sebaceous cyst, or in connection with disease of other tissues, as in lupus erythematosus. The hair and hair-follicles and the nails are invaded by numerous pathological processes, either idiopathically, as in tinea tonsurans, tinea favosa, and the like, or symptomatically, as in alopecia, eczema, psoriasis; also as a result of nervous shock, fevers, and other general diseases.

ANÆMIA.

The subject of anæmia may be conveniently arranged in two divisions,—the GENERALIZED and the LOCALIZED. Both forms are of considerable importance in cutaneous medicine. Anæmia does not produce substantive diseases, as does inflammation, but, like hyperæmia, its influence upon the skin is marked, and often is significant.

GENERALIZED ANÆMIA.

In this division the first variety to be distinguished is that in which there exists an alteration in the quantity or the quality of the blood in the general circulation; a second variety is that in which the anæmia is confined to the skin and exists in a diffused form. In the first the calibre of the blood-vessels is in the beginning not at all or but little implicated.

The anæmia may be due to a deficiency in the number of the red corpuscles or to an increase of the white corpuscles. Such a deficiency occurs in chlorosis, and in the various forms of inanition due to lack of proper food or to malnutrition, and in certain cachexias, as tuberculosis and carcinoma; also in pseudo-leucæmia and in hydræmia. In certain other morbid processes, as in leucæmia, there is an increase, both relative and absolute, in the number of the white corpuscles. In poisoning of the blood, due to varied causes, the quality of this fluid is deteriorated, there existing usually a deficiency in the red corpuscles.

Universal cutaneous anæmia also precedes and accompanies cerebral anæmia, as met with in fainting, nausea, sea-sickness, and similar conditions, the skin becoming blanched or of an ashy-gray color. These colors, also observed in cholera and other diseases, are due to the general contraction of the blood-vessels of the skin.

The part that the cutaneous blood-vessels play in anæmia of the skin is worthy of consideration, their general contraction, transient or permanent, under the influence of impaired functional power of the central nervous system, arising from varied causes, being in certain diseases marked. General tonic contraction of the peripheral vessels occurs in the course of the acute infective diseases, due to the circulating poison acting upon the vaso-motor centres. Fall of peripheral with increase of internal temperature takes place in these instances, the whole economy being affected. In general hemorrhage from wounds and other causes, the cutaneous capillaries are not only deprived of their usual amount of blood, but also contract and become temporarily smaller in calibre, the skin taking on a yellowish, waxy, or translucent appearance.

The remarks thus far made concern general and diffused anæmia.

LOCALIZED ANÆMIA.

The local or circumscribed anæmias of the skin are the result either of a primary vascular constriction in the vessels of the skin, or of a diminished supply of blood to the part, due to a narrowing of the calibre of the larger vessels supplying the skin. The first may be regarded as a primary, the latter as a secondary form. Cold applied to the surface of the skin acts differently according to the degree: thus, the effect of slight or moderate cold is to produce a congestive hyperæmia, or a "healthy" flush, but if the cold be carried to an extreme degree it produces a paralysis of the vessels and anæmia. The effect of prolonged exposure to cold water, or to alternating cold and hot water, is noted in washerwomen, whose fingers may become anæmic or cyanotic, and the disturbed circulation of the parts may be accompanied by pain, heat, or itching. A similar condition exists in pernio, or frost-bite, in Raynaud's disease, especially in the early stages of the latter, and in some other forms of local asphyxia.

The calibre of the vessels of the integument supplying circumscribed or diffused areas may be diminished through inflammatory changes and the deposit of connective tissue in their walls. Emboli and thrombi may also occur in these vessels, producing atrophic, anæmic lesions of one kind or another, for the most part characterized by condensation of the connective tissue. Obliterating closure of the blood-vessels (endo-arteritis obliterans) is productive of a good many anæmic, often atrophic, localized changes in the skin. Marked examples of patches of anæmic skin, some small, others large, due to a diminution of the calibre of the vessels from varied causes, are met with in keloid, morphœa, scleroderma, maculæ et striæ atrophicæ, striæ gravidarum, certain forms of alopecia, as alopecia areata, and cicatrices in general. The pale anæmic skin met with over certain tumors, where the skin is much stretched and the nutrition impaired, as in sebaceous cyst and the like, may also be referred to.

The general subject of anæmia of the skin is of special interest from a diagnostic point, and hence to the clinician. Much is to be learned from the anæmic conditions of the skin, especially when viewed as indexes to general pathological processes.

HYPERÆMIA.

Cutaneous hyperæmia consists essentially of an excessive, but not necessarily a large, amount of blood in the vessels and capillaries. Its seat is mainly in the papillary layer of the corium. It is therefore a well-defined disturbance of circulation, and, being confined to the vessels, is comparatively a simple process. It is for the most part an ephemeral or transitory condition, lasting a variable period, on its subsidence leaving the skin in a normal state. This observation applies particularly to the active forms of the process, the passive congestions being often accompanied by vascular changes, as seen, for example, in rosacea and telangiectasis.

CLINICAL FORMS.

The hyperæmias as a class possess certain characteristic clinical features whereby they may be recognized. Their existence is always marked by redness of the skin, varying in color from pink to dark or bluish red, the tint depending upon the degree of the arterial or of the venous involvement, and upon the superficiality or the depth of the process. As a rule, the redness is superficial, and in the active hyperæmias disappears readily under external pressure, but returns instantly. They may be local and circumscribed, or, on the other hand, diffused or generalized. Sensations of heat, burning, or tingling often accompany the acute forms, but such symptoms may be lacking. The temperature of the surface of the skin is variable. In the active forms it is generally elevated, but in the passive forms it may be diminished. The acute forms may continue for hours or days, the period being extremely variable; not infrequently they relapse. The passive forms are irregular in their course, and often are slow or chronic.

The hyperæmiæ are met with in connection with a multitude of pathological conditions, and play a very important part, from a diagnostic as well as from a pathological stand-point, in cutaneous medicine, especially in the early stages of disease. They give rise to a great variety of manifestations upon the surface of the skin, which frequently are irregular as to size, shape, and outline. Thus, puncta, macules, orbicular, circinate, striate, and gyrate lesions, and reticulated, arborescent, or marbled patches, often large and wide-spread, are met with. Some of the so-called erythematous affections belong to the class of hyperæmiæ, but most of them are more properly grouped with the superficial inflammations, being accompanied by a variable, often slight, amount of exudation.

ACTIVE AND PASSIVE HYPERÆMIÆ.

Hyperæmiæ, or congestions, may be ACTIVE or PASSIVE. This division is of importance, for their clinical appearances and their significance are quite different. They must, therefore, be clearly distinguished. The former constitute the ACTIVE ERYTHEMATA or CONGESTIONS, the latter the STASIS ERYTHEMATA or CONGESTIONS or the so-called CYANOSES. The active hyperæmiæ are known clinically by their bright-red color and their accelerated blood-current, and the passive hyperæmiæ by their dusky-red or bluish-red tint and a retardation of the blood-current.

The arteries, arterioles, and veins all play an important part in this process, the excess of blood present being due to a decrease in the contractile power of the vessels. The normal tone is lacking, and dilatation follows. In some cases the arteries are especially implicated; in others the veins are at fault.

As Unna[1] has pointed out, the arterial, active hyperæmiæ are the result of a relaxed state of the capillaries, due to inhibiting or paralyzing influences, owing to which circumstance the current flows more freely and rapidly. The passive hyperæmiæ are due to stagnation, or stasis, characterized by a more or less distinctly marked retardation of the circulation; but the vessels are by no means inactive in the process. In the active, or relaxive, hyperæmiæ the resistance in the walls of the vessels is impaired and is below normal, the vessels being paralyzed, while the current is accelerated. In the passive, or obstructive, hyperæmiæ the resistance is increased beyond the normal, while the blood current is retarded. The supply of blood to the part is interfered with; it is limited in quantity, while at the same time the return flow from the affected area is obstructed. There thus results a variable degree of stasis. Thus these two conditions of the circulation, while they both give rise to congestions, are the opposite of each other pathologically.

In addition to the dusky-red or bluish-red color noticeable in the passive hyperæmiæ, there sometimes occurs œdema of the integument, together with a lowered temperature, either with or independently of œdema. This diminished temperature indicates faulty innervation generally, as shown by other changes, as in the altered secretion of the glands of the skin. A marked example of the latter condition is met with in acne rosacea and rosacea, especially of the cold or non-inflammatory type so common in elderly persons. The passive hyperæmiæ and the venous congestions, livido and the like, as H. Auspitz[1] showed by experiments with the ligature and other mechanical devices, are largely dependent upon obstructions in the veins, the most varied cutaneous vascular lesions, both as to color and as to form, being producible by such factors.

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[1] Allgemeines über Hyperæmien der Haut, Monatsh. f. prak. Derm., Bd. ix. (1889) No. 2.

CAUSES.

The hyperæmias may arise from innumerable and varied, sometimes directly opposite, causes. Thus, heat and cold, various internal irritants, acting directly or reflexly, systemic disorders due to drugs, poisons, microbes, and manifold other causes, including local injuries and irritants, may all give rise to circumscribed or diffused congestions. The causes may provoke an IRRITATIVE HYPERÆMIA (the "neurotonic congestion" of Recklinghausen), or a PARALYTIC HYPERÆMIA (a "neuro-paralytic congestion"). The former are so common as not to require special remark, while the latter may be illustrated by reference to the erythematous conditions met with after injuries to nerves, especially of the extremities, as glossy skin and the like. Nerve influence generally has much to do not only with the production of the congestions of the skin, but also with their form and outline on the surface. Thus, the circinate and annular erythemata, spreading on the periphery and clearing away in the centre, are distinctly indicative of irritation of cutaneous nerve filaments, as illustrated by tinea circinata, due to the trichophyton fungus. The vaso-motor system is especially involved in the production of hyperæmic cutaneous lesions, especially through the muscular coat of the arteries.

Cold, especially if long continued in its action, plays an important part in producing stasis in the vascular system. By causing contraction of the vessels, the blood-supply and the proper nutrition of the part are interfered with. According to the degree to which the cold is carried, and its persistence, will the skin become reddened or inflamed, or on the other hand whitened, with the result possibly of becoming gangrenous. The cold produces a paralytic angioneurosis in these cases, common examples of which occur in frost-bite, or pernio, in certain forms of rosacea, and in telangiectasis, as seen in sailors, cabmen, and others exposed to wind and cold weather. In this connection the passive congestions which occur in the legs and feet of persons who stand much, leading frequently to varicose veins, may be referred to.

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[1] Über Venöse Stauung in der Haut. Wien, 1874. Also Viertelj. f. Derm. u. Syph., Heft I., 1874.

COURSE AND TERMINATION.

True hyperæmia is not followed by desquamation, this symptom, when it occurs, indicating that some cellular exudation from the vessels has taken place. Pigmentation is a much more common accompaniment or sequel than desquamation, especially in the passive forms of congestion, examples of which are common on the legs, particularly about the ankles. In these cases œdema, especially the inflammatory variety, is also a factor in the pigmentation. Instead of hyperæmia terminating as a simple disturbance of circulation, it may readily proceed further and become inflammation. This course, it need not be stated, is of very common occurrence. Thus, it will be noted that hyperæmia may exist alone, running its course from beginning to end as hyperæmia, but inflammation cannot exist without having been preceded by hyperæmia. Clinically, the line separating the two processes is generally ill defined, it being difficult to state when hyperæmia ceases and when the inflammatory process begins. At the same time there are many hyperæmic affections pure and simple, and hence the importance of a class devoted to the hyperæmiæ.

ŒDEMA.

Œdema is characterized by the presence of serous fluid in the tissues outside of the vessels, from which latter it has emanated by having oozed through their walls. The fluid transuded from the blood which constitutes the œdema contains considerably less albumen than the plasma of the blood. It is always poor in albumen, this constituent being variable in amount. Œdema is a condition which plays a part of considerable importance in connection with many affections of the skin and the subcutaneous tissue. It is intimately associated with disturbance of the circulating fluids, especially with venous blood and lymph. It is often a result of hyperæmia and of inflammation, and is therefore appropriately considered here. The process which gives rise to œdema is a complicated one.

It has been shown, in considering the hyperæmiæ, that in active congestion the current of the blood is augmented and accelerated, while in passive congestion it is lowered and retarded. When the current stagnates or arrives at a stand-still, STASIS is said to occur. But stasis may result from other causes than mechanical obstruction. Thus, cold and heat, alcohol, chloroform, and the like, and various other agents which produce contraction and relaxation of the blood-vessels and disturbances generally of the circulation, may be factors. The relation of the tone of the veins to that of the arteries is of importance, a preponderance in the tonicity of the veins, according to Unna, giving rise to œdema. The existence of œdema may be regarded as signifying a difference between the arterial and the venous circulation. Spasm of the veins is caused by a sudden contraction of the muscular coats of these vessels. This, in order to produce SPASTIC ŒDEMA, must be greater than the corresponding contraction of the arteries. This form of œdema pursues an extremely variable course, but usually vanishes gradually, a much longer time almost invariably being required for the disappearance of the lesion than for its formation.

Two principal varieties of œdema are met with in the integument, one being mechanical in its origin, the other being due to more or less well defined inflammatory changes. They are known as MECHANICAL ŒDEMA and INFLAMMATORY ŒDEMA.

MECHANICAL ŒDEMA.

Unna[1] has called attention to the fact that experimental pathology teaches that the closure of all the lymphatic channels of a limb does not cause œdema in it, while, on the other hand, a venous obstruction never fails to give rise to it, from which observation the conclusion may be drawn that the lymphatics of the skin are only an occasional channel for the return of lymph, carrying back to the blood only that portion of the lymph which does not return by the venous capillaries into the veins. It is the veins, therefore, rather than the lymphatics that are in the first place concerned in mechanical œdema. This observation is proved by the fact that œdema of this nature is produced readily by a bandage applied tightly to the upper part of an extremity, causing compression of the veins and arrest of the venous current. In these cases the lymph-vessels probably take no part in producing the œdema which so soon follows; but abnormal distention, stasis, and obstruction in the lymph-vessels may lead to softening of the tissue and thus to œdema.

It is well known that general venous congestion gives rise to œdema of the entire skin, which is usually more pronounced in some localities than in others, as the eyelids, ankles, and feet; and venous thrombosis, especially of the smaller veins, likewise produces a variable amount of œdema. Unna is of opinion that contraction of the walls of the veins, giving rise to stagnation of the blood, must be regarded as a factor in some forms of œdema, as in the circumscribed œdemas and in urticaria. Gravity is another factor in the production of mechanical œdema.

The degree of elasticity of the skin which is preserved in œdema determines the amount of pitting on pressure. The longer the œdema has existed, as a rule, the greater is the loss of the elasticity of the skin. In certain forms of œdema, especially where the skin is thin or much distended, as in those due to inflammation, blebs are liable to form in the epidermis, which break down, giving rise sometimes to a trickling of serous fluid.

INFLAMMATORY ŒDEMA.

Inflammatory œdema may result from acute, subacute, or chronic inflammation, and is due to disturbance in the circulation of the lymph.

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[1] Loc. cit.

This latter occurs owing to the fact that in inflammation of the skin the absorptive power of the veins is small, unusual strain thus falling upon the lymphatics. It is met with, more or less well developed, in many diseases of the integument. Marked changes occur in the walls of the blood-vessels in these cases, as noted in elephantiasis and allied forms of hyperplasia, including certain chronic eczemas of the leg. Inflammatory œdema is richer than mechanical œdema in soluble albumen and colorless round cells. It may be due to some of the same general causes that produce mechanical œdema.

ANATOMY OF THE WHEAL.

The close relation that œdema bears in some cases to inflammation is seen in the production of the wheal and allied forms of cutaneous tumefaction. The wheal is an inflammatory œdema, in some cases confined to the skin, in others involving the subcutaneous connective tissue. It is a spasmodic or SPASTIC ŒDEMA, and is characterized by a tense, elastic swelling, usually with a defined outline separating it from the surrounding normal skin. Unna[1] believes that it is caused by a sudden obstruction to the venous circulation, brought about by abnormal nervous impulses raising the tone of the veins. It is sharply defined because the normal lymph-spaces permit only a small amount of the fluid to be carried off. H. Leloir[2] found in a section of a wheal dilatation of the blood-vessels and lymph-spaces of the corium; œdema of the corium; and the invasion of the corium by a large number of leucocytes, either isolated between the meshes of the connective tissue or formed in groups, the latter being particularly marked about the blood-vessels and lymphatics, sebaceous and sweat glands. T. C. Gilchrist[3] describes a similar condition, the results being obtained from studies on a number of lesions. He has shown that in a well-developed wheal of urticaria factitia the pathological anatomy is that characteristic of inflammation, consisting of dilated blood-vessels and lymphatics, large numbers of polynuclear leucocytes, especially inside and around the veins, the presence here and there of small quantities of fibrin, and an increased number of mononuclear cells (lymphocytes), found particularly around the vessels. The texture of the tissue is looser than normal, due to the increased exudation of serum, and sometimes there exists an œdematous condition of the connective-tissue cells of the papillæ.

There are other œdemas to be referred to, depending upon recognized causes, such as the TOXIC and INFECTIOUS, with changes in the blood, THERMIC, and TRAUMATIC, all of which may show themselves in varied forms. The œdemas of kidney disease and scarlatina may be viewed as probably belonging to the toxic varieties, of which the œdema resulting from the bites of poisonous serpents may be taken as the type. Another form is that known as HYDRÆMIC or CACHECTIC, in which the blood is poor in its solid constituents, differing from the inflammatory form in the fluid containing less albumen and fewer corpuscular elements. Unna states that the hyperplastic processes which characterize elephantiasis due to varied causes, including filariæ, are the result of the preceding inflammatory processes (of erysipelas in particular), and not of the œdema.

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[1] "Oedem," Monatsh. f. prak. Derm., Bd. x. (1890), Nos. 3 and 4.

[2] Traité Descriptive des Maladies de la Peau, Symptomatologie et Anatomie Pathologique, par Leloir et Vidal, Livraison vii. Paris, 1894.

[3] Paper on the anatomy of the wheal, read before the Section of Dermatology of the Amer. Med. Assoc., Baltimore, May, 1895.

The course of œdema in general is variable. In some cases, as in ordinary urticaria, giant urticaria, and acute circumscribed œdema, it arises, as a rule, rapidly, and disappears gradually; while that met with in connection with renal disease is generally slow in forming.

INFLAMMATION.

DEFINITION AND SYMPTOMS.

It is difficult to present a satisfactory definition of inflammation, for the reason that the process embraces a whole series of phenomena in which both the circulation and the tissues are involved. The phenomena are better understood than is the process. The latter is distinctly complex. There are many changes involved in it. The degree to which these advance has much to do with the results produced in the tissues. The causes are both numerous and diverse.

Viewed from a clinical and a pathological point together, it may be briefly defined as a process characterized by changes in the circulatory system, exudation of the fluid and corpuscular elements of the blood, attended by redness, swelling, heat, and pain. Since the period of Celsus the latter striking clinical signs (RUBOR, TUMOR, CALOR, et DOLOR) have been known as the "cardinal symptoms of inflammation." These signs of inflammation, however, vary considerably according to the degree and the form of the process, and some of them may be greatly modified. The changes which take place concern the vessels and the texture of the tissues invaded, and are intimately connected. Functional and nutritive disturbances also occur, with perversion of the peripheral, sensory, and motor apparatus. Pathologists are disposed to attach considerable importance to the disturbance of function accompanying inflammation, designating it FUNCTIO LÆSA.

The redness is due not only to the dilatation of the vessels and capillaries, but also to the exudation of the red corpuscles, and to the presence of hæmoglobin in a state of solution. The swelling is the result of the infiltration of the tissues by the fluid exuded from the vessels. The heat is due to chemical changes which have occurred in the blood, including augmented oxygenation; while the pain is accounted for by the tension which the exudation has produced, and by the pressure on the nerve filaments of the tissues. Chemical changes in the blood must also be regarded as a factor of pain. Concerning the temperature of an inflamed area, observation confirms the doctrine held by Hunter, namely, that it is in direct proportion to the degree of hyperæmia in the area.

THE PROCESS.

One of the first changes noted is vascular dilatation. Some observers believe that this is preceded by molecular alteration in the walls of the vessels. The process may be plainly described as follows. The first stage is that of hyperæmia,—an abnormal collection of blood in the vessels and capillaries. After a variable period this is followed by dilatation, with an accelerated blood-current, subsequent retardation, and contraction in the calibre of the vessels. The corpuscular elements accumulate, and a condition of stasis results. At this stage the colorless corpuscles adhere to the sides of the vessels and show increased activity of movement, embedding themselves in the coats of the vessels and working their way through the vessels into the tissues beyond. A variable, usually large, amount of the liquor sanguinis readily transudes through the vessels. In high grades of inflammation especially, the red corpuscles also are forced through the walls, though this occurs passively, and not actively as in the case of the leucocytes. This process of DIAPEDESIS, now so well known, is a very important one in inflammation, and explains what formerly seemed obscure. The cause of the extrusion through the walls of the corpuscles was once thought to be blood-pressure,—a point upon which Cohnheim laid much stress when he said, "without blood-pressure no diapedesis." It is now believed that this is due to their own active movements. The great activity of the leucocytes is in strong contrast with the more passive movements of the red corpuscles. The leucocytes are to be regarded as the principal actors in inflammation.

According to Metchnikoff[1] and others, the two varieties of leucocytes which play the principal part in inflammation—the mononuclear leucocytes and the neutrophile cells—are elements endowed with considerable chemotactic and physiotactic sensibilities; are capable of amœboid movements; and are prone to englobe and digest different foreign bodies, especially a number of living microbes.

Next in order after the leucocytes, the vessels and their endothelium play the most important part in inflammation, processes, protuberances, or buds of protoplasm making their appearance, which later often form loops and vascular channels. Another important factor is the contractility of the endothelial cells, as shown by the studies of Stricker and others. While connective-tissue cells proliferate in an inflamed area, the fixed connective-tissue corpuscles probably take little or no part in the production of inflammatory cells.

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[1] Lectures on the Comparative Pathology of Inflammation. London, 1893.

THEORIES OF INFLAMMATION.

The various older theories of inflammation (including the CELLULAR, the VASCULAR, the NEURO-VASCULAR, the NERVOUS, the NEURO-PARALYTIC, and the TROPHIC) are all unsatisfactory in many particulars. Different views are held by modern observers concerning the pathology of inflammation, as shown by the varied definitions proposed by distinguished observers. B. Sanderson[1] defines it to be "a succession of changes which occur in a living tissue when it is injured, provided that the injury is not of such a degree as at once to destroy its structure and vitality." Ziegler[2] regards it in the light of a pathological exudation from the blood-vessels, produced by harmful agencies, associated with a local degeneration of the tissues, with a tendency to regeneration or to hypertrophy of the granulating tissues. J. C. Warren[3] defines inflammation as "a lesion in the mechanism of nutrition, owing to which its efficiency is impaired, but which, if not so severe as to cause death, produces conditions favorable for the protection and repair of the part."

Metchnikoff[4] has brought forward a theory, which might be termed the biological or comparative theory of inflammation, since it is founded on a comparative study of the pathological phenomena presented by living cells. According to these views, "inflammation generally must be regarded as a phagocytic reaction on the part of the organism against irritants. This reaction is carried out by the mobile phagocytes sometimes alone, sometimes with the aid of the vascular phagocytes or of the nervous system." This observer holds that in the struggle between the organism and its aggressors some of the combatants by virtue of natural selection survive, while others, eliminated by the same means, perish. He concludes that all other phenomena are merely accessory to this process, and may be looked upon as means to facilitate the access of phagocytes to the impaired part.

Of late much stress has been laid upon chemotaxis as playing an important part in inflammation. It consists of an attractile or repellent power possessed by cells. It includes the various forms of sensibility of bodies to chemical agents. The studies of pathologists and biologists show that the phenomena of sensibility play an important part in pathological processes, in cryptogams, bacteria, and other forms of life. Two forms are distinguished. In POSITIVE chemotaxis the bodies approach the others with which they have to establish relations, whereas in NEGATIVE chemotaxis they are enabled to escape injurious influences.

Both acute and chronic inflammations are due to various causes, which may be chemical or physical, or, as is more usually the case, biological in nature. It has been abundantly shown that all factors which tend to lower the vitality of a part render it more liable to the exciting causes of inflammation; and that the kind and the degree of the inflammation largely depend upon the existing conditions, and upon the infecting organisms which influence or complicate the process. Experiments show that the nervous system has a distinct influence on inflammation, serving to accelerate or to retard its course, but its importance is probably not so great as was formerly believed.

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[1] A System of Surgery, edited by T. Holmes, vol. i. London, 1883.

[2] Lehrbuch der Allg. Pathologie und Pathologischen Anat., Bd. i. [Allg. Path.], 8te Auflage. Jena, 1895.

[3] Surgical Pathology and Therapeutics. Philadelphia, 1895.

[4] Op. cit., p. 186.

COURSE AND TERMINATION.

Inflammation may be ACUTE or CHRONIC in its course, depending upon the nature of the cause and its continuance in relation to the affected part. These terms apply not so much to the length of time the process has existed as to the changes that have been produced in the tissues. The integument, the corium in particular, tends to take on in a striking manner chronic inflammation. Thus it results that a large number of the diseases of the skin incline to pursue a long-continued rather than an acute course, and to undergo gradual rather than sudden change. The process may terminate in many ways, the commoner being resolution, or absorption, organization and granulation, serous discharge, suppuration, desquamation, and hyperplasia. A tendency of the inflammatory process is to lead to marked increase in the connective tissue, in the form of diffused or circumscribed sclerosis. Other forms, the result for the most part of long-continued irritation, occur especially in connection with the chronic inflammations, due to varied causes; of these, nutritional and degenerative states of the tissues, necrosis, ulceration, and gangrene, may be mentioned. The inflammatory degenerations include many forms of regressive lesions, some of which are so special as to be looked upon as diseases. Hypertrophies and atrophies, the latter in particular, are not infrequently the result of varied chronic forms of inflammation.

Inflammation and all inflammatory processes tend to destroy tissue. This is due largely to cellular infiltration, especially in the case of the connective tissue. Even the elastic tissue suffers. Passarge and Kroesing[1] have shown that in all inflammations, especially hyperplastic and degenerative processes, and in various new growths examined by them, the disappearance of the elastic tissue corresponded with the intensity and duration of the pathological process. Similar observations have been made by V. Mibelli.[2] Infiltration is the most damaging of all the accompanying symptoms of inflammation.

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[1] Schwund und Regeneration des elastischen Gewebes der Haut unter verschiedenen pathologischen Verhältnissen. Hamburg, 1894.

[2] Quoted from J. Sofflantini's article on "The Elastic Tissue in the Fibrous Neoplasms of the Skin." Archives de Méd. Expér. et d'Anat. Path., 1er Mars, 1898, No. 2.

PRODUCTS OF INFLAMMATION.

The products of inflammation as met with in the skin consist of fluid, semi-fluid, or formed materials. Typical fluid exudation occurs in the vesiculation of eczema and herpes, and in a less pronounced form, accompanied with swelling and œdema, in urticaria and erythema multiforme. It occurs in the form of blebs in erysipelas, pemphigus, and other diseases. Bullous formations in general, in almost all cases, are indicative of greatly disturbed nutrition of the affected area. They are usually the result of impaired innervation, and in consequence are distinctly under the direct influence of the nervous system. Pus, in the form of variously sized and shaped pustules and areas of pustulation, as in impetigo, ecthyma, and acne, and in cutaneous abscesses, is a common product of the inflammatory process. In other cases firm, plastic or fibrinous material, sharply circumscribed or diffused, is formed, giving rise to firm papules, tubercles, and patches, as in eczema, psoriasis, lichen planus, and many other diseaess. The various forms of sclerosis, due fundamentally to an increase of connective tissue, are among the commonest products of inflammation, as seen in many diseases, for example, in chronic eczema rubrum of the leg, and in various elephantiasic forms of disease. The lines which separate the several products of inflammation, however, are often ill defined, intermediate stages and forms being common upon the same subject. Thus, in eczema, vesicular and papular lesions are frequently met with together, in combination with varied intermediate forms.

SEAT OF LESIONS.

The seat of the cutaneous primary lesions due to inflammation depends largely upon the disease, each process having more or less predilection for certain tissues, strata, and parts composing the integument. The papillary layer, the body of the corium, the subcutaneous tissue, the sebaceous and sweat glands, the follicles, the blood-vessels, and the lymph-vessels are all liable to special invasion. Fluid exudation, especially serous, commonly seeks its outlet between the strata of the epidermis, occasioning vesicles or blebs or an excoriated surface, as noted in eczema madidans. In other cases the exuded fluid permeates the meshes of the corium or subcutaneous tissue as a serous infiltration, characterized by œdema. Plastic or fibrinous exudation is usually seated in the corium, giving rise to papules, tubercles, and patches variable in size and shape. Purulent products tend to form in the follicles and glands, in the papillary layer of the corium, and in the subcutaneous tissue. When deeply seated the fluid inclines to find its outlet through the natural avenues, namely, the follicles and glandular ducts.

To describe the pathological anatomy of the varied forms of erythema, vesicles, pustules, papules, tubercles, and other lesions, would be to enter upon the domain of special diseases, inasmuch as there exist many varieties of these lesions, differing in important particulars.

SUPERFICIAL AND DEEP-SEATED FORMS.

In considering the subject of inflammation of the skin distinction must be made between the superficial and the deep-seated forms. Many affections of the skin are superficial in their seat from the beginning to the end of the process; others beginning upon the surface rapidly work downward through the natural *viæ* (the follicles and ducts) until the corium and subcutaneous tissue are reached, as in furuncle, sycosis, certain carcinomata, and many other diseases.

The greater number of inflammatory cutaneous diseases are SUPERFICIAL INFLAMMATIONS, characterized by erythema, wheals, papules, tubercles, vesicles, blebs, and varied modifications of these lesions. In this division are found eczema, psoriasis, and various other similar affections marked by the presence of erythema, vesicles, pustules, scales, and other lesions. The development of these several so-called primary lesions of the skin and the innumerable modifications which they undergo constitute a large part of the symptomatology of cutaneous medicine and surgery. The most common and striking form of superficial inflammation, whether acute or chronic, is seen in eczema, a disease having its seat primarily in the papillary layer of the corium and epidermis. It finds its analogy in catarrhal inflammation of the mucous membranes. DEEP-SEATED INFLAMMATIONS are illustrated by such diseases as phlegmon, furuncle, carbuncle, and actinomycosis, in which both the corium and the subcutaneous tissue are invaded. In various deep-seated inflammations both the sebaceous and the sudoriparous glands, and the hair-follicles, are frequently involved.

VARIETIES OF INFLAMMATION.

Two kinds of inflammation may be properly distinguished. The first of these is known as SIMPLE INFLAMMATION, examples of which are observed in the healing of healthy wounds, irrespective of their cause. This form of inflammation runs a course pointing towards repair and recovery. It shows a disposition to confine itself to the part involved, and not to spread. It is an uncomplicated and non-infective process, and is simple, non-destructive in its nature. The second form is that known as INFECTIVE INFLAMMATION, which is due to the presence of bacteria. It is a simple inflammation that has become complicated, and constitutes a graver form of the process. Pyogenic cocci play an important part upon the skin, being present in many cutaneous diseases, of which abscesses and boils are common types. Bacteria are, practically speaking, present in all suppurative diseases, for it is now generally understood that foreign substances, mechanical irritation, and the like are unable to produce suppurative processes without the presence of bacteria.

As distinguished from septic infection from bacteria, must be mentioned TOXIC INFECTION, induced by such poisons as the ptomaines and the like, capable of producing local or general disease, especially the latter. It is probable that these poisons are accountable for certain angioneurotic dermatoses, as, for example, some forms of urticaria and œdema.

FORMS OF INFLAMMATION.

The variety of the inflammation is determined by numerous factors, among which may be mentioned the anatomical seat of the disease, the nature and character of the irritating agent, and the duration of the process. The varieties affecting the skin are particularly numerous, are due to diverse causes, and give rise to a multitude of lesions and modifications of lesions having certain peculiarities, constituting many of the diseases of the skin.

All the tissues except the epidermis may be primarily the seat of inflammation. But the epidermis does not escape damage, being always more or less involved and altered secondarily, and often in a remarkable degree, as evidenced by the scaling and vesiculation in such diseases as psoriasis and eczema. Although the epidermis is not supplied with blood-vessels, it receives nutrient fluid from the lymphatics and possesses nerves in abundance, so that in every way it is in the closest touch with the vascular system of the corium. It occupies, consequently, a very important place in many inflammatory processes.

The skin is subject especially to œdematous, serous, purulent, fibrinous, hyperplastic, hemorrhagic, degenerative, and desquamative inflammation, all of which appear in various modified forms, capable of division and subdivision into special forms. Œdematous inflammation, or inflammatory œdema, is observed in urticaria and in certain affections complicating the lymphatic system. The most striking example of serous inflammation of a catarrhal nature occurs in vesicular and moist eczema, while the squamous variety of the same disease affords a good illustration of desquamative inflammation; but psoriasis is more uniformly desquamative. In serous inflammations the number of leucocytes is small, and consequently the part they play is not so important as in the catarrhal, fibrinous, or purulent variety; but the serous exudations sometimes constitute a congenial fluid for various microbes, which flourish and multiply in it, while in other forms they are scanty or altogether absent.

The formation of pus, constituting purulent or fibrino-purulent inflammation, occurs very frequently both on the general surface of the skin and throughout its structure and in the subcutaneous tissue, as noted in various pustular lesions, in excoriated surfaces of the skin, in ulcers, and in abscesses. Pus occurs in dermatoses quite different in their nature. Thus, the bacilli of tuberculosis and of anthrax, the virus of chancroid, the streptococcus pyogenes, and the staphylococcus pyogenes aureus, albus, etc., all occasion suppurative lesions variable in their clinical aspects. In the great majority of cases the micro-organisms are staphylococci or streptococci.

The affections of the skin which arise from the inoculation of the agents of suppuration have been grouped together by H. Leloir[1] under the heading of the "pyodermata." They may be divided into two groups: (1) those produced primarily by the agents of suppuration and dependent entirely upon these,—the pure and simple pyodermata,—examples of which are found in furuncle, carbuncle, certain varieties of folliculitis, ecthyma, and impetigo; (2) those in which the action of the agents of suppuration is superadded to some pre-existent pathogenic cause, as noted in impetiginous eczema, eczema complicated with ecthyma or with abscess, and the like. Inoculation may occur directly from the outside, the common way; or, more rarely, from the interior, through toxines formed by microbes, and through impairment of the resisting power of the individual cells to these destructive agents.

PYÆMIA AND SEPTICÆMIA.

Pyæmia (literally meaning pus in the blood, which it was formerly supposed to be) is a complication of suppuration. It is a purulent infection, the system being invaded in most cases from a wound. It generally occurs through the blood-vessels, sometimes through the lymphatics. But pyæmia may occur without the existence of a wound. The intermittent type of fever and the chill usually render the diagnosis easy, especially if there exist a suppurating wound. The micrococci are staphylococci and streptococci.

Septicæmia (signifying putrid blood), known formerly as "febris putrida," is a grave, often fatal, type of surgical fever. Billroth[2] has said that it bears the same relation to surgical or traumatic fever that pyæmia does to suppurative fever, each being the malignant type of the corresponding milder affection. It is occasionally encountered in connection with certain well-defined cutaneous diseases, as, for example, impetigo herpetiformis. The source of infection may be obscure.

INTERSTITIAL, HEMORRHAGIC, AND NECROTIC FORMS.

In interstitial, or fibrinous, inflammation the parts around the blood-vessels—in other words, the connective tissue—are involved. This form of inflammation is seen in many diseases of the skin. It is much more common in chronic than in acute diseases, lichen planus and other varieties of lichen affording marked examples.

Inflammation in connection with hemorrhage, especially the existence of the former process in consequence of the latter, is not infrequently met with, especially in the infective varieties of inflammation. It is noted in a typical form in erythema nodosum, and in other diseases due to various causes. There exist in most cases intense congestion, stasis, diapedesis of the red corpuscles, and sometimes thrombus.

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[1] Des Pyodermites, Jour. des Mal. Cut. et Syph., No. 7, 1893.

[2] Quoted from J. C. Warren's Surgical Pathology and Therapeutics, Phila., 1895, p. 334.

Necrotic inflammation, characterized by the inflammatory products tending to necrose, sometimes rapidly, in other cases slowly, is met with in furuncle, carbuncle, and the varied forms of acute and chronic gangrene. In some cases of localized disease the necrosis is traceable directly to nerve influence, especially in connection with the hands and feet, particularly the fingers and toes.

Dermatoses terminating in necrosis, suppuration, ulceration, or granulation tissue, the latter constituting the so-called "granulomata," in many instances belong to the class of diseases due to infective poisons, of which variola, phlegmon, gangrenous bedsores, hospital gangrene, malignant pustule, anatomical tubercle, tuberculosis, and granuloma fungoides are striking examples.

PIGMENTATION.

In connection with many forms of inflammation there occurs a variable degree of pigmentation, the deposit taking place early in the process or towards the close, in which latter case it may be viewed in the light of a result of the inflammation. It has been shown in considering the anatomy of the pigment that this product emanates from the blood and is deposited in a variable form in the skin and elsewhere. Pigmentation being a physiological process as well as a pathological result, intermediate stages between the two states are common, as seen, for example, in freckle, in pigmentary mole, in the discoloration of the skin peculiar to pregnancy, and in other conditions. Certain simple inflammatory diseases of the skin, as, for example, chronic eczema, especially of the legs, lichen planus, prurigo, pediculosis corporis, and various forms of dermatitis, as from sunburn and the like, are accompanied or followed by pigmentation. In some of these cases the pigment is deposited in abnormal amount as an essential part of the pathological process, as in lichen planus; in others it is deposited as a result of local irritation, as occurs in sunburn and from scratching.

Pigmentation is also met with very frequently accompanying and following various forms of passive congestion, the result of extravasations through diapedesis from the capillaries and larger blood-vessels. Varicose veins, thrombi, and ulcers, especially about the leg, and other conditions in which venous congestion occurs, all tend to give rise to this form of pigmentation. Chronic inflammations, simple and specific, are also prone to be accompanied by pigment deposit of this kind. Thus, it occurs conspicuously in syphilis and lepra, and in many other diseases. In other cases it is directly under the control of the nervous system, illustrative of which form changes in the color of the hair may be cited.

In the beginning of the disintegration of the red corpuscles the coloring matter is hæmoglobin. Changes occur rapidly in this product, giving rise to the derivatives hæmatoidin (identical with bilirubin) and hæmosiderine, the former containing iron and the latter being free from iron. Pigmentation disappears by absorption through the vessels.

CAUSES OF INFLAMMATION.

The causes of inflammation are numerous. They may be considered under the heads of predisposing and exciting. Both forces are important, but the latter especially demands attention here. They may be divided into those which act upon the skin from without and those which exert their influence from within. To the former belong all manner of mechanical and physical injuries, including heat and cold and changes of temperature; irritant or corrosive poisons; animal and vegetable poisons; and animal and vegetable parasites, the two latter giving rise to defined groups of dermatoses. Specific poisons, as, for example, that of chancroid, also provoke definite forms of inflammation. Not less numerous are those causes which act from within, through various natural channels. Thus, many drugs and poisons entering the circulation find their way to the skin, there setting up inflammation, variable in form and in degree. Specific diseases, including acute specific fevers, also play a conspicuous part in producing cutaneous inflammation.

MICRO-ORGANISMS.

The relation of bacteria, bacilli, micrococci, and the like to inflammation is now well known. These factors produce both general and local disturbances, a marked example of which is observed in erysipelas. The so-called INFECTIVE INFLAMMATIONS, depending upon the action on the tissues of living organisms, constitute an important group of diseases. The two chief factors in their production are the micro-organisms, or germs, and the soil, or the peculiar state of the tissues, in which they live and multiply. A suitable soil seems in many cases to be necessary for their growth. This fact has long been recognized in the case of the vegetable parasites of the skin, as ringworm, which grows or at least thrives only upon certain kinds of soil. The nature of this peculiarity of the skin, favorable to the growth of the fungus, we are unable to define.

The micro-organisms attacking the skin may be specific, as in the case of the bacilli of leprosy, or non-specific, as in the simple inflammations. The observations of Metchnikoff and others go to show that the white corpuscles of the blood are the chief opponents to micro-organisms, and that the conflict is in the main between these bodies.

Concerning the avenues by which microbes enter the body through the skin, Wasmuth's[1] experiments upon the lower animals and man with pure cultures of staphylococcus and with the cocci of erysipelas and carbuncle indicate that the bacilli tend to enter between the root-sheath and the hair-shaft, rather than through the unobstructed openings of the sweat or sebaceous ducts.

Kriloff's[2] experiments with tartar emetic ointment in the form of inunction upon animals point out that pustulation is induced only in those cases where the ointment is not sterilized, the microscope showing the staphylococcus pyogenes, which this observer and others regard as the principal cause of all suppuration. The weight of authority in experimentation with microbically pure mechanical and chemical substances is in favor of the view that they are not able to produce suppuration.

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[1] Abstract in Jour. Amer. Med. Assoc., April 22, 1893.

[2] Universal Annual of the Med. Sci., edited by Sajous, 1889.

That pus microbes are the only essential cause of suppuration seems to be proved by abundant clinical and experimental evidence. The well-known experiments of Bockhart may be referred to. This observer inoculated in the skin of his forefinger a mixed cultivation of staphylococcus aureus and albus, which was followed in forty-eight hours by a small abscess, the pus of which on being opened contained streptococcus pyogenes aureus. The same author inoculated into the skin a mixture of staphylococcus pyogenes aureus and albus, which was followed in fourteen hours at the site of inoculation by twenty-five pustules which contained the cocci injected.

Finally, mention must be made of the influence of the nerve centres and nerve trunks and branches in the production of inflammation. The neurotic inflammatory dermatoses constitute an extensive and important group, the cutaneous manifestations being due either to functional and organic disturbances of the central or ganglionic nervous system or to direct irritation of the nerves supplying the part. This irritation may be in the form of some palpable injury or may be due to micro-organisms or other causes.

The subject of the antagonism of micro-organisms is one of interest, especially as it pertains to therapeutics. Thus, observation has shown that the streptococcus erysipelatis is antagonistic to the bacillus of anthrax, as demonstrated by the experiments of Watson Cheyne on rabbits. Neumann and Schwimmer have both noted that the presence of erysipelas had a marked effect in modifying syphilitic cutaneous lesions. Babtchinsky's[1] series of cases of inoculation go to show that an antagonism exists between erysipelas and diphtheria.

The line separating some of the inflammatory diseases, whether affecting the skin or other organs, and the so-called new growths, or neoplasmata, is often indefinite, so much so that certain dermatoses might with almost equal propriety be arranged in either class, as, for example, lupus erythematosus and lupus vulgaris. The occurrence of distinct diseases combining or of one disease supplanting another must be kept in mind, as happens occasionally with such diseases as lupus and cancer. Inflammations and hypertrophies are found merging into each other in some cases, so that not infrequently it becomes difficult to distinguish between these processes. The varied modifications of a recognized definite process which may possibly occur should always be borne in mind. Diseases are not in all cases the entities we have been so long accustomed to consider them. Frequently they are composed of several processes, and they may be otherwise complicated.

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[1] Abst. in Lond. Med. Record, March 20, 1890.

METASTASIS AND EXCRETION.

The subject of metastasis, or the shifting of the disease-process from one locality to another, is not difficult to comprehend in the light of modern pathology. It occurs at times in a striking manner in the eruptive fevers, and also in other diseases, especially in those of microbic origin. This question has not received the attention at the hands of pathologists which it deserves. Perhaps the most generally recognized manifestation of metastasis occurs in gout, and the correlation between gout and eczema is generally admitted. A typical eczema may show itself during an acute attack of general gout, the disease of the skin being relieved by colchicum, while a general gouty attack may be relieved by the outbreak of an acute eczema.

These questions, including the subject of excretion, viewed from the stand-point of cutaneous medicine, have been discussed by Walsh,[1] who, justly in the author's opinion, directs attention to the importance of inflammatory irritation of the skin due to excretion. Thus, dermatitis may be set up in a certain number of cases by the excretion of various irritant products from the system, which may be chemical or microbic in nature. Some inflammations may be looked upon as simply expressions of excretory irritation. The severity of the inflammation and its results are generally in proportion to the specific action of the irritant on excretory epithelium. Parallels may be drawn between drugs and the poisons of specific diseases, both as regards their harmfulness to epithelium and their channels of elimination. Excretion through the skin not only affords a key to a certain number of inflammatory dermatoses, but also accounts for the success of many well-established methods of treatment which aim at changing the channels of elimination.

CUTANEOUS AND MUCOUS DISEASES.

The relation of cutaneous to mucous diseases, and *vice versa*, has not received the consideration it deserves. The subject of "internal cutaneous diseases," paradoxical as the term may seem, is of much interest. It refers to the manifestation upon the mucous membrane of lesions in nature and in character similar to or identical with those which occur on the skin. The two coverings of the body, the skin and the "slime-skin" (*Schleimhaut* of the Germans) or mucous membrane, have a similar development and are naturally closely correlated. They are subject to the same processes, and manifest similar or like changes, modified by their respective structures. In many instances it is merely the difference in the structure of the skin and of the mucous membrane that gives rise to different lesions; thus, in syphilis upon the skin there is formed a flat papule, and upon the mucous membrane a so-called mucous papule or patch. These are the same general expressions of the disease, differing only in their seat, and modified by the anatomy of the membrane. The subject of certain cutaneous diseases, especially those of an inflammatory nature, such as eczema, herpes, psoriasis, pemphigus, and the like, attacking the mucous membrane of the respiratory or alimentary tracts, is in every way worthy of attention and investigation. That certain processes may sometimes simultaneously or alternately invade skin and mucous membrane is an observation that must be admitted. In the case of pemphigus this occurrence is not uncommon. The pathological correlation of these membranes in such cases admits of no question. When the disease on the mucous membrane is present, frequently it does not occur as a defined or obvious lesion or visibly. In the vast majority of cases of so-called skin diseases, on the other hand, disease of the mucous membrane is altogether absent, the process being confined strictly to the cutaneous membrane. From the stand-point of therapeusis, especially in the consideration of internal *versus* external treatment, the question should, in appropriate cases, as, for example, in pemphigus, receive due attention.[1]

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[1] Med. Press and Circular, 1890; also Brit. Med. Jour., August 26, 1893.

HEMORRHAGE.

Cutaneous hemorrhage consists in the extravasation of blood from the vessels into the surrounding tissues, the result either of the filtration of the fluid through the walls of the vessels without rupture, known as DIAPEDESIS, or of rupture of the capillaries, termed RHEXIS. In hemorrhage from rhexis the determination of blood usually occurs in a circumscribed area and is pronounced, giving rise to varied lesions, especially ecchymoses and hæmatomata. It is generally the result of local traumatism. In some cases it is difficult to determine whether the hemorrhage has occurred by the former or by the latter process. When it takes place through rhexis, the blood escapes suddenly and rapidly through the wound in the vessels; in diapedesis the corpuscular elements filter through (but not necessarily slowly) the walls of the vessels together with the serum, the red corpuscles being numerous, in which particular hemorrhage differs from the inflammatory process.

CLINICAL FORMS.

Hemorrhagic lesions consist of variously sized, diffused or more or less circumscribed aggregations of blood, or material containing blood, often commingled with varied pathological products, having their seat in the corium or the subcutaneous tissue. They possess certain features by which they may be recognized.

They generally make their appearance suddenly. Having once assumed a definite size and form, they usually retain it until, by the gradual process of absorption, they fade and finally disappear. They are reddish in color, varying in shade from bright to dark, according to their nature, location, extent, and the length of time they have existed. About the period of their decline they commonly exhibit more or less pronounced yellowish, bluish, and greenish hues, this coloration being typical in contusion. The variations are due to the changes which the coloring matter of the blood undergoes. The products of cutaneous hemorrhage are peculiar in that they do not disappear under pressure. They are usually upon a level with the surrounding skin, though occasionally they become elevated in the form of papules, tubercles, or tumors; this, however, rarely takes place except in extensive extravasations or in those cases in which the hemorrhage accompanies other lesions as a secondary symptom, as in hemorrhagic variola. The seat of the process may be in the papillary layer or in the body of the corium, as in purpura simplex or in the deeper parts of the integument. It may also occur about the glands, especially the sweat-glands, and around or in the follicles. Cutaneous hemorrhage is at times painful, but more often a sense of soreness or swelling is complained of, and in rare cases more or less itching or burning. Frequently there are no subjective symptoms. The lesions, as a rule, disappear slowly by absorption, leaving a variable amount of discoloration of the skin, which sooner or later passes off.

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[1] See a suggestive article by J. Clifford Allbutt, in Arch. of Derm., Oct., 1876, p. 1.

Hemorrhage through diapedesis occurs as a result of venous engorgement, stasis, or inflammation. In purpura the hemorrhage is mainly confined to the capillaries and arterioles, and is due chiefly or entirely to diapedesis. Clinically, as well as pathologically, hemorrhage is found to complicate various pathological processes, especially inflammation. Its occurrence in these cases is generally associated with a debilitated or a depraved state of the tissues or of the blood, as, for example, in scurvy and in purpura from drugs. Micro-organisms are also at times present, clogging up the capillaries and causing thrombosis. Various diseased states of the economy may be accompanied by hemorrhage, as, for example, poison wounds, scarlatina, morbilli, cerebro-spinal fever, typhus fever, septicæmia, endocarditis, and other infective and toxæmic processes. The lesions in the skin are petechial spots or ecchymoses, due to changes in the blood or in the walls of the vessels, and sometimes, as already stated, to accumulations of bacteria in the arterioles.

CAUSES OF HEMORRHAGE.

The causes which give rise to hemorrhage are varied. In the first place, general venous congestion must be regarded as a factor disposing both to rupture and to diapedesis, as noted in affections characterized by paroxysms, as whooping-cough, in which hemorrhagic lesions are liable to occur. Changes in the walls of the vessels, such as thinning, fatty and other forms of degeneration, and also thickening (from endarteritis), are all liable to cause breaking down of the vessels and rupture or diapedesis. The various forms of purpura are for the most part neurotic or infective processes, the blood filtering through the vessels, the result of a local or general weakness or stasis. Many infective forms of purpura may be explained on the theory of coagulation thrombi produced by bacteria. The neurotic hemorrhages are due to perverted or faulty innervation, and are met with in many diseases. Affections of the nervous centres, and certain emotional states of the nervous system, as exemplified in hæmatidrosis, stigmata, and the like, are often accompanied by varied hemorrhagic lesions, particularly petechiæ. Hæmophilia, in which the general vascular system is involved, is a hemorrhagic diathesis, and is hereditary. It is characterized by a lack of coagulating power in the blood and a deficiency in the retractile and contracting power of the arterioles.

HYPERTROPHY.

DEFINITION AND SYMPTOMS.

Hypertrophy may be succinctly defined as an increase in the amount of a tissue which already exists. It is characterized by an increase in bulk and size of the structures invaded. It may take place either by an increased growth of the already existing elements or by the formation of new elements of the tissue: thus, a cutaneous capillary may become enlarged or a series of new capillaries may form. The term is employed in a broad sense, and takes in the changes which occur not only in the connective tissue composing the bulk of the skin, but also in the epidermis. The appendages of the skin may also be often involved in the process, either alone or in connection with invasion of the neighboring structures, as the general epithelial surface or the connective tissue. Hypertrophy may be LOCALIZED or GENERALIZED, an example of the former occurring in wart, and of the latter in ichthyosis. The localized forms are not usually sharply defined in outline, but rather incline to spread out, as in callosities and in some of the other keratodermata.

CLINICAL FORMS.

The process may take place as a simple hyperplasia without inflammation, whether in the epidermis or in the corium. Typical hypertrophy of the epidermis occurs in callosity. In ichthyosis, corn, horn, and wart it involves both the epidermis and the papillary layer of the corium. Hypertrophy of the connective tissue is very common, giving rise to numerous changes, some being slight or ill defined, while others are extensive and striking. The latter form is best illustrated by elephantiasis and allied elephantiasic affections due to varied causes. As an example of simple hyperplasia of the corium and subcutaneous tissue, without inflammation, acromegalia may be cited. Hypertrophy is in many instances intimately associated with the inflammatory process, common examples of which are found in chronic eczema, especially of the legs, and in elephantiasis. It is also closely connected with œdematous processes, many forms of hyperplasia taking their origin in œdema, usually in inflammatory œdema. Hypertrophy and atrophy sometimes occur together, further reference to which occurs in the consideration of atrophy.

CAUSES OF HYPERTROPHY.

The causes are found in increased functional activity, pressure, friction, œdema, and inflammation. Modified forms of the two latter processes, giving rise to disturbed nutrition, faulty innervation, and obstruction, especially venous, are frequently the causes of increased growth. The skin, being an exposed membrane, is subject to the most varied external irritating agencies, many of which act not only upon the epidermis but also secondarily upon the corium. Certain occupations are directly accountable for some forms of hypertrophy of the integument. Thus, local thickenings of the epidermis and even of the entire integument are of common occurrence in connection with mechanics who use tools, porters, and others who are compelled to subject certain localities to constant or interrupted pressure. Friction and pressure are also accountable for the common corn upon the foot.

HYPERTROPHY OF PIGMENT.

Under the head of hypertrophies in general, the subject of the excessive development of pigment may be referred to. In considering inflammation it was stated that the pigment is derived through complicated processes from the blood, from which source it is deposited in different forms in various parts of the body, physiologically and pathologically. As concerns the skin, abnormal pigmentation has its seat not only in the mucous layer of the epidermis, but also in the corium. The milder and commoner expressions of abnormal deposits are encountered on the face and body in pregnancy (chloasma uterinum), in freckle, and in pigmentary moles and warts; also in chloasma in general, in Addison's disease, and the like. The most pronounced forms occur in the malignant, blackish, bluish, so-called melanotic growths, especially in melæno-sarcoma. The pigmentation which occurs as a result of extravasations of blood into the integument undergoes chemical decomposition accompanied with variations in color. The hæmoglobin is set free from the corpuscles in solution, but soon takes on a granular or crystalline form, the former being yellow, orange, brown, or black in color. The darker-colored granular products are somewhat vaguely designated as MELANIN.

ATROPHY.

DEFINITION AND SYMPTOMS.

The process of atrophy is the opposite of that of hypertrophy. It is characterized by a decrease in the size or in the number of the histological elements which make up the structure. It consists in want of balance between the nutritive supply and the part to be nourished. Cutaneous atrophy may appear as a simple, reduced, wasted, thinned, shrunken, pale or whitish, dry, smooth or scaly condition of the skin, as is seen in maculæ et striæ atrophicæ and atrophia cutis propria. It may also take on peculiar degenerative changes, as occurs in morphœa. It may be GENERAL, affecting more or less the whole surface, as in senile atrophy, or PARTIAL, involving circumscribed areas, as in atrophic macules and streaks, and alopecia areata.

SENILE ATROPHY may be taken as the type of general atrophy of the cutaneous structures. The skin becomes thinner, owing to the alteration in the papillary layer, the papillæ shrinking and flattening. The vessels become obliterated here and there, and the connective tissue bundles take on a form of hyaline degeneration. The elastic tissue also undergoes regressive changes. The epidermis in consequence wastes, the corneous layer becoming dry, brittle, and scaly. L. Heitzmann's[1] studies upon pathological atrophy of the skin in general lead to the conclusion that the process commonly designated as wasting or atrophy cannot be explained on the ground of there occurring a direct decrease in size of the bundles of connective tissue. The observations point rather to a rejuvenation of the tissues of the corium, occurring through a return to the embryonic stage of indifferent elements, this taking place, of course, after a melting-down and fusion of the collagenous substance.

But other and complex changes occur in the skin, a common form consisting of varied degenerations, often fibrous or fatty, with vascular involvement. Such changes, as well as certain other forms of atrophy of the skin, are generally the result of disturbed nerve influence, either central or in connection with the nerves innervating the region or localities affected. The appendages of the skin, either in connection with the corium and subcutaneous tissue or alone, are often affected. The hair in particular, as in alopecia and in other diseases, is prone to suffer; so also are the nails. Both the hair and the nails frequently serve as infallible indexes of disturbed or diminished general as well as local nutrition.

CAUSES OF ATROPHY.

The common causes of atrophy of the skin are diminished blood-supply, injury to nerves, and impairment of nerve function. As a result of one or another of these conditions follows naturally disordered nutrition, the immediate cause of the atrophy. As examples of disease due to faulty nerve-supply and consequently impaired nutrition, morphœa and hemiatrophy of the face may be cited. Neuritis, especially the multiple variety, characterized by pain, burning, tingling, pricking sensations, numbness, erythema and other forms of neuritic hyperæmia and dermatitis, is a common cause of atrophy. Another cause is pressure, especially when prolonged. Thus, in tinea favosa the fungus grows so luxuriantly and in such quantity that the pressure downwards on the skin produced by the growth gives rise to a chronic inflammation and simultaneous atrophy of the connective tissue of the corium. Certain forms of suppurative diseases are attended with atrophy, particularly in connection with the hair-follicles and with the glands; as striking examples, some forms of folliculitis of the scalp and face, and acne, may be cited.

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[1] Die Atrophien der Lederhaut, Archiv für Derm. u. Syph., Bd. xxii. (1890) S 660.

While hypertrophy and atrophy express diametrically opposite conditions, it is nevertheless true that in certain pathological processes they occur simultaneously in the same subject, and moreover side by side. Such pathological processes occur in vitiligo, scleroderma, and morphœa, and in certain rare affections of the hair. Hence in some diseases it is difficult, if not impossible, to state whether the process should be regarded as a hypertrophy or as an atrophy. The proper solution of such questions is reached by keeping in mind the predominant process, with reference especially, in the author's opinion, to its ultimate course and termination. Thus, for example, inasmuch as morphœa tends distinctly to atrophy, it is proper to regard it as an atrophic rather than as a hypertrophic disease. In like manner scleroderma should be grouped with the atrophic diseases; for, while it often begins with œdema and increase in the connective-tissue elements of the integument, the course is towards condensation and ultimate atrophy. It is proper to state that the corium is not so prone to take on atrophic as hypertrophic action.

TROPHIC DISEASES.

The so-called trophic diseases of the skin are those which are considered to be under the influence of nerves governing the normal metabolism of the tissues. The existence of a distinct set of nerves governing nutrition has not been proved, and it is likely, as Cohnheim[1] has stated, that every motor and sensory nerve is at the same time a trophic one so far as it plays a part in the metabolism and therefore in the nutrition of the various tissues and organs of the body. Function and nutrition are probably but different states of the same process. Both regulate the general metabolism of the body, and both are governed by the nervous system, which influence plays a particularly conspicuous part in the production of atrophic diseases of all kinds. Disturbances of nutrition, or trophic disorders, affecting the cutaneous system are manifested in their simplest form by such conditions as thin, dry, or fissured skin, defective nail- or hair-growth, and the like, while the more advanced stages of faulty innervation are productive of positive atrophies and hypertrophies of various kinds of the skin and of its component parts, and of varied forms of neuritic inflammation. Defective nutrition of the skin plays an important part in dermatology, the visible signs of which are both numerous and diverse in character.

The vaso-motor disturbances of the skin, following H. Kriege[2] in the study of the general subject of the "traumatic neuroses," may be arranged in three groups, the first including abnormal flushing and ERYTHEMATOUS conditions; the second, ŒDEMATOUS and urticaria-like manifestations, transient, and without the peculiar subjective symptoms attending true urticaria; and the third, LOCALIZED CYANOSES, which may attain to such a degree as to be worthy of the name of local asphyxia (Raynaud's disease), the condition probably being due to vasomotor spasm.

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[1] General Pathology, vol. ii., New Sydenham Society's translation. London, 1889.

[2] Arch. für Psych., Bd. xxii., 1890.

NEOPLASMATA.

DEFINITION AND GENERAL CHARACTER.

NEOPLASMS, known also as NEW GROWTHS and NEW FORMATIONS, consist of a development of tissue which is new or foreign to the structure in which it occurs. They constitute a large and important class of diseases. The process producing them differs from that of simple inflammation in several particulars. The ordinary clinical signs of inflammation are generally wanting in most of the diseases which belong to this class. The inflammations tend primarily to break down the tissue in which they occur, whereas the new growths are constructive, building up new formations, as shown by single or multiple swellings, infiltrated areas, tubercles, and tumors. They incline to form permanent structures, in contradistinction to the more transitory formations of simple inflammation. In the neoplasmata the cells thrown out are for the most part peculiar as to their arrangement, their grouping, the region of the tissue they attack, and their form, while in the inflammations they are wandering leucocytes, possessing no special peculiarities.

CONNECTIVE-TISSUE AND EPITHELIAL FORMATIONS.

The two great divisions into which most of the new growths fall are those characterized by CONNECTIVE-TISSUE FORMATIONS and those in which EPITHELIAL PROLIFERATION prevails. To these groups may be added a third, the GRANULOMATA. In the first group there exists an abnormal growth of the connective-tissue elements, as, for example, in fibroma, with marked development of this tissue in the form of bundles of fibres. In another variety, xanthoma, a fatty degeneration of the connective tissue occurs; in myoma new muscular tissue springs up; while in angioma the vessels develop new tissue. New growths of the epidermis may be typical in their expression, as in the case of cutaneous horns and warts, with a tendency to proliferate outwards; or they may be atypical, with disposition to grow inwards and downwards into the corium. The former are for the most part innocent, but the latter tend to malignancy and to destroy the tissues which they invade. In addition to these forms the glands of the skin not infrequently take on a simple new growth, constituting the so-called adenomata, of which group sebaceous adenoma is the most striking illustration. The atypical epithelial growths comprise the so-called cancers, of which there are two principal kinds, depending on the variety of epithelium. The squamous epithelium, as seen in the epidermis, gives rise to the so-called "epithelial cancers," or epitheliomata, while the spheroidal epithelium and columnar epithelium produce the "gland-cancers." It is probable that the clinical form of cancer known as rodent ulcer has its starting-point in the sebaceous glands. The epithelial new growths have a tendency to begin about follicular and glandular orifices and at the junction of cutaneous and mucous surfaces.

GRANULOMATA.

The group of diseases known as the GRANULOMATA or the INFECTIOUS GRANULOMATA, comprising such diseases as tuberculosis, lupus vulgaris, syphilis, leprosy, glanders, granuloma fungoides, and malignant pustule, occupy a position in pathology between the inflammations and the new growths proper. They are made up of a structure resembling granulation tissue. Some of these diseases pursue an acute course, as malignant pustule, others, as leprosy, an exceedingly chronic course. They consist of small cellular elements in an embryonic stage of development, and have their seat at first mainly in the corium. They undergo involution by breaking up, becoming cheesy, suppurating, ulcerating, or undergoing absorption with atrophy and cicatrix. Some of the granulomata are notable for their resistance to necrobiosis.

CAUSES OF NEOPLASMATA.

The causes which give rise to new growths are often obscure, but such factors as mechanical injury, irritation, and friction are well known to be able to start up some of these processes, as in the case of epithelial cancer of the lip. In other cases the presence of a bacillus must be regarded as the cause, as, for example, in such diseases as lupus and leprosy. New growths are sometimes innocent in their behavior, as in the case of the fibromata and other connective-tissue formations, but often they tend to be malignant, characterized by recurring after removal, by destroying the tissues, by setting up a cachexia, and by ending fatally in exhausting the system. The two most malignant diseases are cancer and sarcoma, the first due to excessive and aberrant epithelial proliferation into tissue other than its own, the second to the development of immature cells, probably connective-tissue cells, into normal connective tissue.

TUMORS.

A TUMOR may be defined as a mass of new growth characterized by enlargement of the part affected and tending to increase in growth and to persist. It is usually a neoplasm. It is composed in almost all instances of some of the natural tissues of the body, which are either in an embryonic or a developed state. The classification of tumors resting upon an anatomical basis thus becomes simple, the fibromata (consisting wholly or partly of white fibrous tissue), the lipomata (of fatty tissue), the angiomata (of blood-vessels), the myomata (of muscular tissue), and the sarcomata (having their type in embryonic connective tissue) serving as common examples of the manner in which such new formations are designated. In addition to those cited, one of much importance, carcinoma (finding its origin in epithelium), may be mentioned. The anatomical or physiological peculiarity of the tissue from which a tumor arises is usually plainly marked in the new growth. Sometimes the elements of the neoplasm are like those of the tissue in which it occurs, in other cases they differ. The former are known as HOMOPLASTIC and the latter as HETEROPLASTIC.

The terms "benign" and "malignant" applied so commonly to new growths possess a meaning which is often relative rather than positive. While it is often impossible to state where the first-named ends and the second begins, the common signs of malignancy apply to the integument much in the same manner as to other organs, especially in the case of the carcinomata and the sarcomata. The value of the microscope in determining the benign or the malignant nature of a new growth is great, and it is remarkable to what degree the work of the clinician and that of the pathologist may be made to aid and to supplement each other. The observation applies especially to the diagnosis of growths, including their probable course, before, and not after, operation; and also the advisability or not of operative interference, the opinion being founded on the histological composition of the growth.

INVOLUTION OF DISEASES.

The involution of the products of pathological processes is a topic worthy of study. Facts have been recorded going to show that many diseases, some of them even so-called malignant diseases, in some cases undergo unlooked-for involution,—different from that usually attributed to the history of the disease. In some cases this is favorable and in others unfavorable to the welfare of the patient. The spontaneous disappearance of lesions is occasionally noted in such chronic or malignant affections as xanthoma, morphœa, scleroderma, vascular nævus, and sarcoma. Some diseases tend to recover spontaneously wholly or in part and then to recur. A striking instance of this behavior of a new growth came under my observation in a case of granuloma fungoides,[1] in which large, firm, protuberant formations appeared and disappeared spontaneously without leaving a trace behind them. Sarcoma is also a disease which in some cases inclines to be distinctly capricious as concerns its involution. Spontaneous withering or disappearance is known to have occurred. A case of idiopathic pigmented sarcoma of the skin, of the alveolar variety, is recorded by Hardaway,[2] which underwent complete spontaneous involution in fifteen years from the beginning of the disease, leaving behind merely an atrophic condition of the skin. The general health was always good, and no treatment had ever been used.

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[1] Archives of Dermatology, Jan. 1879, and Jan. 1880.

[2] Jour. of Cut. and Gen.-Urin. Dis., 1890, p. 21.

The combining or merging of distinct diseases, forming anomalous or hybrid pathological conditions, also occurs not infrequently, giving rise to COMPOSITE DISEASES, examples of which are seen in acne rosacea and seborrhœic eczema, and among the neoplasmata in fibroma, angioma, lymphangioma, and the like.

PARASITES.

Parasites of the skin are those organisms, animal and vegetable, which prey upon the cutaneous tissues. They produce a variable degree of disturbance, chiefly in the form of inflammation. In some cases this is acute, in others chronic. The subject may be considered appropriately and conveniently under the head of vegetable and animal parasites.

VEGETABLE PARASITES.

These consist of minute microscopic plants of a low order, which under certain favorable conditions attach themselves to the surface of the skin and the epidermic appendages, as the hair-follicle, hair, and nail, and there vegetate, producing definite structural changes in these tissues. Primarily the seat of the growth is in almost all cases in the epithelial tissues, but secondarily, through irritation, disease of the corium is generally provoked, and occasionally the latter structure itself is invaded by the parasite. The fungus has its habitat, however, chiefly in the horny layer of the epidermis, penetrating between the cells, thus causing their more or less complete destruction, with exfoliation or desquamation. Hyperæmia or inflammation variable in degree is set up sooner or later, occasioning desquamation, or vesiculation, pustulation, and crusting. The symptoms produced by the several fungi are peculiar, and give rise to different and well-defined lesions. Even the same fungus, attacking one or another tissue or structure, produces different pathological forms or lesions.

The fungi belong mostly to the order of hyphomycetæ, or moulds, and have jointed mycelial filaments, or hyphæ, and spores, or conidia. They are a low order of plants, and draw their sustenance chiefly from the epithelial tissues. On some individuals they are barely able to live, causing but little disturbance in the skin, while on others they thrive luxuriantly, growing rapidly and giving rise to much disturbance. A certain state of the epidermis, or soil, the exact nature of which is obscure, is required for their development, without which favorable condition they fail to take root and to grow, or at least to thrive. Thus it happens that such diseases prove contagious for some individuals and not so for others.

Concerning the soil, H. Leslie Roberts,[1] of Liverpool, from his studies deduces the fundamental principle that "every individual fungus modifies the soil it thrives in, and every soil may impress some variation on the fungus it nourishes." Some of the fungi are non-pathogenetic rather than pathogenetic, as, for example, the aspergilli.

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[1] Introduction to the Study of the Mould-Fungi Parasitic on Man. Liverpool, 1893.

VARIETIES OF FUNGI.

The three common varieties of fungus, occurring widespread in the world, which invade chiefly the epidermic structures, each producing disease having distinctive features clinically and pathologically, are the achorion Schönleinii, causing tinea favosa; the trichophyton, giving rise to three common affections, namely, tinea circinata, tinea tonsurans, and tinea sycosis; and the microsporon furfur, which produces tinea versicolor. There is no doubt that there are differences in the form of the trichophyton fungus, giving rise to distinct varieties, as was first pointed out by Furthmann and Neebe,[1] who described four. Later, Sabouraud[2] distinguished two, namely, trichophyton microsporon and trichophyton macrosporon, and expressed the opinion that they belonged to the genus botrytis. The observations of Rosenbach[3] partly corroborate the earlier studies of Furthmann and Neebe[4] and of Sabouraud.[5] Rosenbach is further of opinion that the superficial and deep-seated cryptogamic affections of the skin may be produced by a number of different fungi. He takes exception to the classification of Sabouraud into small and large spores, and believes that the parasitic form of the fungus is not the normal form of the growth.

The aspergillus is also met with on man, chiefly in connection with inflammatory diseases of the ear, but it may occur upon the general surface, in most cases saprophytically rather than pathogenetically.

Other and different fungi are productive of disease, as actinomyces, or ray-fungus, causing actinomycosis, also the parasite found in mycetoma, or fungus-foot of India, the precise nature of which is not fully determined. Finally, the bacteria causing certain diseases involving the skin, as erysipelas and variola, may be alluded to, but they constitute another and a different group of diseases, to be referred to hereafter.

MICRO-ORGANISMS.

The subject of micro-organisms as causes of cutaneous disease is one which, on account of the difficulties attending its consideration and its magnitude, must be briefly discussed. The presence of bacilli, cocci, and the like in connection with many of the diseases of the skin has been conclusively proved. By the term "diseases of the skin" are meant the manifestations or evidences of all pathological processes which in any way, directly or indirectly, affect the skin, either primarily or secondarily.

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[1] Monatsh. für prak. Derm., vol. xiii., 1891, p. 477.

[2] Annales de Derm. et de Syph., Nov. 1892, p. 1061. See also his work "Les Trichophyties Humaines." Paris, 1894.

[3] Ueber die tieferen eiternden Schimmelerkrankungen der Haut. Wiesbaden, 1894.

[4] Monatsh. für prak. Derm., vol. xiii. p. 477.

[5] Annales de Derm. et de Syph., Nov. 1892, p. 1061.

In the list are to be included some of the acute and chronic infectious diseases as well as other diseases which heretofore have been excluded by most authors from works on dermatology.[1] The question whether these micro-organisms are causes of the disease or not in all instances cannot be discussed. In some cases they undoubtedly are the causes, and these concern this work particularly. Upon the epidermis numerous micro-organisms have been found, most of which, however, seem to be harmless. Some, as the trichophyton in ringworm, have long been known to be productive of disease, while others as factors of disease occupy positions as yet undetermined.[2] Striking examples of cutaneous diseases caused by micro-organisms are found in erysipelas, and in suppurative inflammations of the skin, as impetigo contagiosa, ecthyma, sycosis, furuncle, and carbuncle. Micro-organisms, as Ogston first showed, are always present in acute suppurative processes, but whether they are the sole cause of the disease is a matter sometimes difficult to determine, for in some cutaneous diseases they seem rather to complicate the original process. The degree of the invasion of the cocci, whether superficial or deep-seated, also plays a part in the production of so-called diseases. The access of the organisms is usually through a breach in the continuity of the epidermis or through the root-sheaths, follicles, and glands. Through these avenues doubtless a number of cocci and bacilli of various species enter the blood- and lymph-vessels, as well as the structures of the skin itself and of its appendages. It will thus be noted that the etiology of cutaneous disease in connection with micro-organisms covers a broad field. Of late years the subject has assumed great importance.

To enumerate the micro-organisms in the form of cocci and bacteria productive of or influencing cutaneous diseases is a task which at the present epoch cannot be satisfactorily performed. The streptococcus pyogenes, first distinguished in pus by Ogston, and first cultivated by Rosenbach, is the organism generally seen in pyæmic affections. The staphylococcus pyogenes aureus is the microbe most constantly encountered in various pustular affections of the skin, in boils, carbuncles, whitlows, and cutaneous abscesses. Garré's well-known experiments showed that he was able to produce by inoculation of a staphylococcus cultivation into the root of the nail of the finger a subcutaneous suppuration, and that with a cultivation of this product carbuncles and boils were produced by rubbing the matter into the skin of the arm. Of the pathogenic bacilli which attack the skin, those of anthrax, tuberculosis, lepra, glanders, and rhinoscleroma may be specially mentioned.

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[1] See an article on "The Scope of Dermatology" by the author, being the chairman's address before the Section of Dermatology of the American Medical Association, in which this idea is more fully elaborated. Jour. Amer. Med. Assoc., 1894.

[2] The subject has been studied by Unna and others. See Monatsh. für prak. Derm., 1890, p. 185.

ANIMAL PARASITES.

The animal parasites all occasion more or less irritation to the skin, chiefly in the form of acute inflammation, produced by burrowing into the cutaneous and other tissues, or by biting, stinging, or sucking blood. The lesions, therefore, are extremely varied. The most prominent among these parasites that burrow is the itch-mite, or sarcoptes scabiei. It is a true parasite. It can live only on an animal body. It burrows into the epidermis on a line just above the mucous layer, and there deposits its ova. Irritation is set up, followed by a variable degree of inflammation and by the formation of papules, vesicles, pustules, and other lesions. When the process has continued for a long period the secondary changes in the skin are marked and extensive, resembling in many respects those of chronic vesicular and papular eczema.

The leptus autumnalis, or harvest-bug, is another mite that burrows to some extent in the skin. It does not, however, have its habitat in the skin, and in this respect it differs from the itch-mite. The demodex folliculorum is a minute worm-like creature which infests the sebaceous follicles and glands. It does not set up any irritation in man, and therefore cannot be regarded as a producer of disease. It occurs more frequently in some skins than in others. Among the burrowing creatures met with in the skin (as the worm makes its exit from the body) the filaria medinensis, or Guinea-worm (dracunculus), remains to be referred to, as well as the pulex penetrans, or sand flea, both of which excite inflammation in the cutaneous tissues. Another worm parasite, known as the filaria sanguinis hominis, has been found in the blood, urine, and lymphatics. It is chiefly encountered in tropical countries, and it would seem enters the system by means of drinking-water, being found later in the blood and lymphatics. By obstructing the circulation it sets up disease of the lymphatics. It is found in some cases of elephantiasis, and in lymph-scrotum.

Among the ectozoa, three species of lice infest the human skin, known as pediculus capitis, pediculus corporis or vestimentorum, and pediculus pubis, frequenting the regions implied in their names. They all derive their sustenance from the skin by drawing blood. The pathological changes produced consist of irritation and inflammation, characterized by hemorrhage, excoriations, and pustules. Scratching also plays a part in the process. The cimex lectularius, or bedbug, the pulex irritans, or common flea, and the ixodes ricinus, or common tick, also visit the body to suck blood, setting up hemorrhagic and inflammatory lesions. Certain flies, as the bluebottle and others, occasionally deposit their ova in the skin, and especially in ulcers and wounds, the larvæ giving rise to local inflammation, at times phlegmonous in character.

PROTOZOA AND SPOROZOA.

The relations that some of the protophyta bear to disease have been much elucidated by the observations of Pasteur in France and Koch in Germany, and by their numerous disciples. In like manner the subject of the protozoa, and especially one division of them, the sporozoa, and the part they play in the possible or probable causation of disease, has recently received much attention from investigators, especially since the publication of the work of L. Pfeiffer,[1] of Jena, in 1891. Protozoa are protoplasmic bodies with granular contents. Sometimes they are encysted, in other cases they show sporulation. The capsules become thinner as the granular contents become separated and the spores are set free through the process of sporulation. The line separating the lowest species of the protozoa from the lowest protophyta is not well defined. Of the class of sporozoa there are two subclasses of special interest to the pathologist of cutaneous medicine, namely, the gregarines and the coccidia, both of which in animal life generally are widely distributed. It is well known that most full-grown rabbits and other animals contain coccidia in the liver and in other organs. Pfeiffer in 1885 published the results of studies upon the bacteriology of vaccine lymph, in which paper were described certain bodies resembling sporozoa and similar to the amœboid bodies previously figured in vaccine lymph by Lionel Beale.

The protozoa considered in relation to cancer, sarcoma, and other morbid growths have recently received much attention.[2] Thus, K. Touton[3] describes and figures a number of protozoid formations occurring in a case of generalized sarcoma of the skin due to leukæmia or pseudoleukæmia. Pfeiffer[4] in 1888 was the first to publish a description of the bodies which he regarded as parasitic protozoa in cancer. As early as 1865 Virchow and others noted the peculiar "molluscum bodies" found in epithelial molluscum (molluscum contagiosum), which were compared to gregarinida, Bollinger maintaining later that they were parasites and comparable to bodies encountered in a similar affection in birds. Darier, of Paris, in 1889 described similar bodies in keratosis follicularis (Darier's disease) and in Paget's disease of the nipple. Darier and others regard the disease as a psorospermosis, and the intra-cellular cells and bright grains as psorosperms. L. Wickham,[5] of Paris, in the same year also elaborated the subject, concluding from his studies that the bodies found were psorosperms. Other observers, however, differ in their interpretation of these bodies, some regarding them as cell-inclusions referable to degeneration or other changes, and not as parasitic. It may be remarked that as far back as 1847 Virchow observed certain enclosures within cancer-cells, which he looked upon as being due to degenerative processes. Sheridan Delépine,[1] of London, who has done good work on the psorosperms of the rabbit's liver, states that the evidences he has been able to collect are against the psorospermial nature of the bodies which he has observed in epithelial tumors and in Paget's disease of the nipple. D'Arcy Power[2] expresses the opinion that the majority of the appearances described by Wickham in cases of "psorospermosis" are due to alterations in epithelial cells, or at any rate that similar appearances may be produced in epithelium by artificial irritation. The whole subject is still under investigation, but the author holds the view (in the light of his examinations of many specimens containing these bodies) that these organisms are probably not parasitic. Neisser[3] is also of opinion that there is no proof that these bodies are parasites, and regards them as abnormal and pathological cell formations; and in the cases reported by Darier and others as "psorospermosis follicularis" this observer thinks it questionable whether the disease may not be looked upon as an inherited keratosis.

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[1] Protozoen als Krankheitserreger. Jena, 1891. The reader may also consult the works of Davaine, "Leçons sur les Sporozoaires," Paris, 1884, and R. Leuckart, "The Parasites of Man," English trans., Edinb., 1886.

[2] An excellent review of the work done in this direction may be found in the Medical Press and Circular, vol. cvii., 1893, by J. Jackson Clarke, of London, to which the author is indebted.

[3] Münchener Med. Wochenschr., Jan. 10, 1892.

[4] See his work "Untersuchungen über den Krebs," Jena, 1893.

[5] Contributions à l'étude des Psorospermoses cutanées et de certaines formes de Cancer: Maladie de la Peau dite Maladie de Paget. Paris, 1890.

CASES OF DISEASE WITH SPOROZOA AND SPOROZOID ORGANISMS.

In order to convey a more definite idea of the sporozoa and allied organisms as they are met with in the human skin, reference will be made to several well-known cases of peculiar or undescribed forms of disease in which they have been found. The subject has recently been investigated by Wernicke, and by Rixford and Gilchrist, but in particular by Gilchrist, who demonstrated bodies of this kind in specimens before the American Dermatological Association in 1894, and before the American Medical Association in 1895. Gilchrist's researches[4] comprise four cases where large numbers of protozoa (subclass sporozoa) or protozoa-like bodies have been found in diseased skin. The first reported was by Wernicke,[5] of Buenos Ayres, and he described it clinically as a "doubtful case of mycosis fungoides." He found the protozoa in large numbers in the pus which exuded from the lesions, and observed as many as sixty organisms in one field of the microscope. The next case recorded was by Rixford and Gilchrist,[6] and was regarded clinically as typical "tuberculosis of the skin." The protozoa were similar to those found by Wernicke, and were just as numerous, but the resulting pathological lesions were almost typical of tuberculosis. The skin lesions remained local for nearly two years, and then the patient died twelve months afterwards of almost general protozoic infection. The peculiar bodies were found in enormous numbers in the lungs, testes, epididymes, spleen, adrenals, surface of the liver, peritoneum, pleura, etc., and the lesions, as in the skin, presented the typical picture of tuberculosis. No tubercle bacilli were found. Successful inoculations were made on dogs and rabbits.

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[1] Trans. Path. Soc. of London, vols. xli. (1890), xlii. (1891).

[2] Jour. of Pathology and Bacteriology, 1894, p. 254.

[3] Abst. in Jour. of Cut. and Gen.-Urin. Dis., Oct. 1892.

[4] The author is indebted to Dr. T. C. Gilchrist, of Baltimore, for the abstract of the microscopical work here given.

[5] Ueber einen Protozoonbefund bei Mycosis Fungoides (?). Centralblatt f. Bakt. u. Parasitenk., Bd. xii., 1892.

[6] Preliminary report read before the American Dermatological Association at Washington, May, 1894. Also read before the Amer. Med. Assoc., May, 1895.

The third case was also reported by Rixford and Gilchrist,[1] and was similar in many respects to the second, except that the disease ran a far more acute course, and the patient died within three months. The protozoa were present in larger numbers in this third example than in the first two cases, and the sporulation forms were also far more numerous. In all these three cases the adult protozoa were easily recognized, stained or unstained, as circular bodies (16 μ to 30 μ in diameter) which consisted of a distinct thick capsule, with granular protoplasmic contents, but no recognizable nucleus, although a vacuole was sometimes made out. They developed by sporulation, but only in the second and third cases was the complete cycle followed out.

The fourth case was recorded by Gilchrist,[2] a unique protozoon-like body having been discovered in a skin lesion occurring on the back of the hand of a man. The case had been under the observation of the author (who furnished the specimen to Dr. Gilchrist), and was regarded by him as a typical chronic "scrofuloderma verrucosa." The histological appearances were somewhat similar to those of the second case. The peculiar bodies were much smaller (10 μ to 15 μ in diameter) than the three other varieties, and developed not by sporulation but by budding. No tubercle bacilli were found. In the last three cases Gilchrist states that there was no similarity between these peculiar bodies and the coccidia of rabbits or the protozoa in the helix hortensis. W. H. Welsh[3] regards the bodies in this case as blastomycetes, or yeast fungi.

Comparisons were made by Gilchrist between the organisms of the second, third, and fourth cases and the so-called protozoa or parasites of cancer (twenty cases of which were examined), of molluscum contagiosum (four cases), of herpes zoster (twenty cases), and of psorospermosis, this observer concluding that there are no justifiable grounds for supposing that the bodies found in these various diseases (including cancer) are parasites, and that they are various forms of degenerated epithelial cells.

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[1] Read before the section on Dermatology of the Amer. Med. Assoc., May, 1895.

[2] Preliminary report read before the American Dermatological Association at Washington, May, 1894. Also read before the Amer. Med. Assoc., May, 1895.

[3] Written communication to the author.

In some cases the peculiar bodies which so closely resemble protozoa are blastomycetes, or yeast fungi. Busse[1] found, in a case of chronic subperiosteal inflammation of the tibia, organisms resembling in form sporozoa, which he considers to belong to the yeast group. He succeeded in obtaining a pure culture from animals inoculated with these organisms. After reinoculation with the pure culture similar pathogenic lesions were produced. Their mode of development was by budding, and, judging from the drawings in Virchow's Archiv, there is a marked similarity between these bodies and those found by Gilchrist in the author's case. Some other bacteriologists, as F. Sanfelice,[2] Maffucci and Sirleo,[3] Roncali,[4] and Fermi and Aruch,[5] also express the view that the so called cellular enclosures, sporozoa, fuchsin-bodies, coccidia, etc., noted by various observers in tumors are in reality yeast-plants. Fermi and Aruch believe a species of yeast to be the cause of a disease of horses in Italy called "farcinoid lymphangitis."

GENERAL DIAGNOSIS.

GENERAL OBSERVATIONS.

It is unnecessary to devote space to elaborating the statement that the subject of diagnosis is one of great importance. If satisfactory results are to be obtained in the treatment of cutaneous diseases, the physician must know definitely what affection he has before him. Without a full comprehension of the symptoms and pathology of the disease and of the course it is likely to pursue, all treatment must be empirical and attended only with hap-hazard results. With the assistance of a method for the examination of cases, and of an understanding of the numerous signs and symptoms encountered, together with a certain amount of clinical observation, there should remain no great difficulty in the recognition of these diseases. Unusual varieties of disease and anomalous cases are not infrequently encountered; but if the types of the well-known and accurately described diseases be kept in mind, it will be found that in most instances the difficulty of classifying cases will be materially lessened. Not only should the lesions and symptoms generally be attentively investigated, but the nature of the pathological process producing the lesions should be noted. Special and general pathology should be studied together. One requisite, it may be stated, is indispensable to success in diagnosis, namely, the power of close observation and scrutiny, without which the student will acquire but a superficial and unsatisfactory knowledge of the subject.

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[1] Ueber parasitäre Zelleinschlusse und ihre Züchtung. Centralblatt für Bakt. u. Parasitenk., Band xvi., Nos. 4 and 5. Also, Ueber Saccharomycosis hominis, in Virchow's Archiv, Bd. cxl., Heft. I., p. 28, 1895.

[2] Ueber eine für Tiere pathogene Sprosspilzart, etc. Centralb. für Bakt. u. Parasitenk., Bd. xvii., No. 4, 1895.

[3] Il Policlinico, March 1, 1895, p. 138. Also, Centralb. f. Allgem. Path. u. Path-Anat., April 30, 1895, Bd. vi., No. 8, and "Neuer Beitrag zur Pathologie eines Blastomycetes," in Centralb. f. Allg. Path. u. Path.-Anat., June 15, 1895, Bd. vi., No. 11.

[4] Il Policlinico, April 1, 1895.

[5] Ueber eine neue pathogene Hefeart, etc. Centralb. für Bakt u. Parasitenk., May 10, 1895, Bd. xvii., No. 17.

The author is indebted to Prof. W. H. Welsh, of Baltimore, for several of these references.

The following points may be considered:

History.—While for the vast majority of the diseases affecting the skin the trained and experienced dermatologist requires no clinical history for diagnosis, close observation of the condition of the skin itself being all-sufficient for this purpose, nevertheless, many instances occur representing unusual or complex cases in which an account of the beginning and the course of the disease is of great assistance. In such cases all the information obtainable, and other aid from whatsoever source, are welcomed. It must be kept in mind, in the study of cutaneous diseases, that dermatology is a distinctly progressive department of medicine, and that new diseases are being described and veritable discoveries continually made by observers. Every source of reliable information, therefore, should be utilized. The clinical history should, as a rule, be taken before the inspection of the skin.

Light.—To examine a case properly, suitable light should be secured. Daylight in some cases is important. Artificial light gives to the skin an unnatural tint, and thus it is easy to fall into an error. A correct idea of the color and shade of the eruption is an important point, upon which alone may depend the diagnosis. Various signs of value frequently come to notice under a strong light which might pass unperceived with an uncertain illumination: thus, a faint patch of tinea versicolor, an early or fading erythematous or a pigmentary syphiloderm, may readily escape detection with an imperfect light.

Temperature of the Apartment.—The patient, whether in bed or on foot, will of necessity be somewhat exposed to the air during the examination, and sufficient warmth is needed to preserve the ordinary temperature of the skin. This is particularly important in the case of the erythematous manifestations, whether simple or specific. The patient should, therefore, be examined in a moderately warm room.

Inspection.—The patient will generally direct attention to a certain region or locality, usually to that part of the disease which causes him the most annoyance. And here, in the first examination, arises an opportunity for the exercise of tact. The portion offered to view should be attentively examined, and perhaps at the same time a few questions asked, with the purpose of gaining the confidence of the patient. The physician should always endeavor to obtain this as soon as possible. With women it should be kept in mind that a feeling of diffidence always exists when called upon to expose to a stranger even a portion of their person, and that to overcome this their confidence must be obtained. It may further be asked what other parts of the body are involved, and to what extent; and thus by judicious questions it will be ascertained exactly what regions and localities are affected. If the disease be generalized, the various parts should be inspected one by one. If the case be that of a man or a child, it is often advisable to examine the whole or the greater part of the body. This proceeding is especially important if the disease manifests a tendency to be disseminated over the general surface, for, as will be shown presently, much is to be learned from the distribution of the eruption.

Examination should be thorough.—The examination during the first interview should, if possible, be complete, for it may happen that by the second visit the lesions will have undergone change and perhaps have lost in a measure their characteristic features. Cases should always be investigated, as concerns the lesions at least, at the time they first come under notice. In order to understand a disease, it is essential to be familiar with all its phases; hence every change in appearance should be recorded.

The general color of the skin should be noted, in order to determine its vascularity and vitality. It should be felt, that its temperature, whether increased or diminished, may be ascertained. In rosacea of the nose, for example, the skin may have the appearance of being warm or inflamed, when touch will sometimes reveal a sense of coldness indicative of a state of lowered vitality. Its softness or harshness, suppleness or firmness or rigidity, should also be noted. Certain diseases may be diagnosed by the sense of touch alone, as, for instance, ichthyosis and scleroderma. The peculiar harshness of ichthyosis is characteristic. Baths influence cutaneous diseases frequently in a striking manner, especially inflammatory eruptions characterized by scaling and crusting. The frequency of bathing should be inquired into. It should be noted whether the body and the skin are fat or lean. It should be observed particularly whether the hair-follicles and sebaceous gland ducts are patulous or obstructed, whether the epidermis is normal or dry and desquamative, and whether the secretion of sweat is scanty, normal, or profuse.

Constitutional Disturbance.—In the majority of the diseases of the skin little or no constitutional disturbance exists. There are instances, however, where more or less distinct systemic derangement, as shown by malaise, fever, headache, constipation, and disordered tongue, is present at some time or other during the course. Symptoms of this character sometimes prove valuable in aiding to decide between affections which resemble one another in external form. The exanthemata, for instance, are always accompanied by elevation of temperature and by symptoms of general disturbance, and at times in their early stages it may be these signs alone which permit the diagnosis from other diseases which they simulate upon the skin. In erythema nodosum and dermatitis exfoliativa the temperature may be high and the patient prostrated. Some of the syphilodermata, and other chronic infectious diseases, as, for example, lepra, are also accompanied by constitutional disturbance and febrile symptoms.

Age.—The age of the patient, whether an infant, a child, an adult, or an old person, is a point to be taken into consideration. It is known that certain diseases occur almost exclusively at certain periods of life; that some are found only in adult life, and that others are common only to infants. It is well known, moreover, that infants and young children are almost exempt from certain diseases; in questions of diagnosis, therefore, these may generally be excluded from the list. For example, psoriasis, one of the most frequent diseases in adult life, is very rarely found in infants, and, as a rule, we need not look for its occurrence before the second or fourth year, while usually it does not show itself until the fifteenth or twentieth year. Epithelioma seldom occurs in early life; it is seen now and then at the age of twenty or thirty, but is not common before forty or fifty.

Sex.—The sex of the patient should be taken into account. Males are more liable to certain affections than females, and *vice versa.* It is also to be borne in mind that, owing to peculiarities in the anatomy of one sex or the other, certain diseases are found in the one which have no existence in the other, as sycosis, found only in the male. Other diseases occur chiefly in one sex or the other; thus, the rare disease impetigo herpetiformis is met with almost exclusively in females.[1]

Temperament.—The temperament or natural general organization of the patient should be noted, and whether the complexion is light and florid or dark and swarthy. It is well known that certain forms of disease are prone to come upon those whose natural physical organizations are of a particular type. Diseases of the sebaceous glands, for example, especially acne and seborrhœa, are much commoner upon persons of the florid type. Eczema likewise occurs much oftener, and is generally more chronic and more obstinate in character, in those of light complexion with flaxen or reddish hair.

Habits.—The habits of the patient should be inquired into, and the ordinary condition of general health ascertained. The state of the alimentary tract, a region so often the seat of derangement in certain inflammatory diseases of the skin, especially among those of sedentary habits, should be searchingly investigated, and not merely the inquiry made whether the patient suffers from "dyspepsia" or "constipation." Questions of this kind are seldom sufficiently definite to elicit the true condition. The digestive tract should be inquired into attentively. In some cases it may be assumed that functional derangement probably exists. In the alimentary canal may often be found the exciting causes of many of the simpler skin diseases of an erythematous or inflammatory type, especially of eczema and of acne. The examination in this direction should be carefully conducted, no point being slighted or passed over, for it may be the exciting cause of the disease.

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[1] See the chapter on "General Etiology." For further information on diseases peculiar to the female sex, the reader may consult an article by the author and M. B. Hartzell in Keating and Coe's Cyclopædia of the Diseases of Women, Phila., 1895.

The tongue should always be inspected, and its condition, if whitish, pinkish, reddish, devoid of normal epithelium, pasty, furred, thickened, moist, dry, or fissured, noted. This organ, in some of the inflammatory diseases especially, is worthy of close observation. At the same time, inquiry into the usual state of the breath may be made, whether heavy or feverish; if impure, the cause frequently will be found associated with digestive or functional nervous disorders. Attention should next be directed to the stomach; and here we must question the patient closely, asking whether he is subject to flatulence, "eructations," "acidity," or "indigestion," or, using the terms more popular among the working classes, "heart-burn" and "water-brash." Persons are not infrequently encountered who will deny all knowledge of dyspepsia or indigestion, but who will admit suffering from heart-burn. In this connection the character of the food taken may be inquired into, to ascertain whether the indigestion is due to certain articles of diet or to other causes, as, for example, a functionally disturbed nervous system, the result of anxiety, strain, worriment, and the like. Finally, the state of the bowels must be investigated, whether normal, temporarily or habitually constipated, or irregular in action. In many cases, especially in generalized eczema, pemphigus, psoriasis, furunculosis, and xanthoma, it is of importance to make an examination of the urine. This procedure should be carried out in the investigation of any extensive, especially inflammatory, disease.

Occupation.—The occupation of the patient sometimes affords a clue to the cause of the disease. It is well known that various kinds of work play a part in the production and continuance of certain forms of disease. An affection perhaps trivial in itself may be aggravated by exposure to irritating substances. For example, a slight eczema upon a washerwoman's hand may be much increased by continued exposure to water and soap, while ultimately a severe eczema rubrum of the arm may result. Workers in the manufacture of chemicals also suffer at times from artificially produced diseases: thus, those who work in mercury and arsenic mines are subject to peculiar forms of eruption, while workers in caustics, acids, iodine, bromine, tar, coal oil and its derivatives, and other substances, may likewise be attacked with simple or peculiar cutaneous disorders.

GENERAL FEATURES OF THE DISEASE.

The disease of the skin itself, including the lesions and their peculiarities, may now be considered. The latter should be attentively investigated, for in most cases they afford the most definite and accurate information which it is possible to obtain concerning the nature of the case; indeed, they sometimes present the only knowledge which can be relied upon. One thoroughly familiar with the various cutaneous lesions is in the majority of cases enabled to comprehend the character of a disease from simple inspection; at the same time, the history of the case may throw much light on the diagnosis, and should always be taken into consideration with the symptoms.

Acute or Chronic.—It is to be noted whether the disease is acute or chronic in its course; and, furthermore, the stage in which it exists, whether upon the increase or upon the decline, is to be observed. In most cases this can be learned by examining the skin itself and noting the pathological changes that have occurred. It is also important at the same time to inquire into the duration of the complaint, and particularly whether it is a first attack or a relapse; and, if the latter, into the behavior of former attacks, and under what general plan of treatment the disease yielded or was aggravated.

Extent of the Disease.—The extent of the affection should be ascertained; whether confined to a certain locality or occurring in various portions of the body. The regions involved should be noted, for it is well known that some diseases, as, for example, seborrhœa, acne, and scabies, have a predilection for certain parts of the body. Other diseases, as sycosis, are encountered only in definite localities.

Distribution.—The distribution of the eruption may often serve as an aid in diagnosis. The configuration and shape of the patches, and the grouping and arrangement of the lesions, are to be observed. In some diseases, as, for instance, in herpes zoster, herpes iris, and the parasitic diseases, especially scabies, these are peculiar. The tendency for certain diseases to localize, as, for example, lupus erythematosus upon the nose and cheeks, is striking. The possible involvement of nerve trunks and branches, especially in chronic inflammatory and atrophic affections, should be investigated.

Color.—The general color or tint of the disease will almost always throw considerable light upon the nature of the process, as, for instance, in many of the syphilitic eruptions, which possess a brownish-red, raw-ham, or coppery tint, frequently with pigmentation, particularly in the case of the papular and tubercular formations. Lupus vulgaris is characterized by a similar color, but it usually possesses a more yellowish or brownish hue, with less pigmentation. The latter point is one often of service in the differential diagnosis between these diseases. The scrofulodermata, as a rule (as they are met with in the United States), show a more violaceous tint than lupus vulgaris, and in this respect they resemble lupus erythematosus. In xanthoma the color is reddish-yellow or yellow; in keloid, pinkish or reddish. In urticaria pigmentosa the color may be much the same as in xanthoma, but usually it is not so yellow and is browner. In chloasma it is pale or dark yellow, or brownish, more or less muddy or mottled. Tinea versicolor is likewise usually characterized by much the same color as chloasma, but it is more uniform in distribution, in addition to which the epidermis is the seat of more or less furfuraceous desquamation. Tinea favosa also shows a distinctly yellowish coloration of the crusts.

It should be kept in mind that the coloring of the skin may possibly be due to foreign matter and pigments, as, for example, from the use of remedies and from chemical changes that have taken place, and also to drugs taken internally, such as nitrate of silver and arsenic. Variegation is also an aid to diagnosis, some diseases—as, for example, erythema multiforme, herpes iris, and purpura—showing, during the evolution of the lesions, varied colors, shades, and tints.

Individual Lesions.—It is to be noted whether the individual lesions are of one or of several varieties, and whether they are all in the same or in different stages of development. Their anatomical situation, as well as their number, is also to be inquired into. It is of the utmost importance to observe their evolution.

MACULES.

Macules are of very frequent occurrence; some remain as such through their entire course, as in chloasma, vitiligo, and tinea versicolor, while others, beginning as macules, gradually or rapidly pass into other lesions, as, for example, papules or tubercles, as seen in syphilis, leprosy, granuloma fungoides, and sometimes in tinea sycosis. Hyperæmic affections, as the simple erythemata, and discolorations of the skin from various causes, including pigmentation, all present examples of macules as their characteristic lesions. Thus, when it is remarked that a disease manifests itself in a macular form, no intimation is given by this statement as to its nature, nor is the diagnosis thereby suggested. The knowledge that it is macular is a vague clue, nothing more. Many diseases diverse in nature show macular lesions at one period or another in the course of their evolution.

PAPULES.

Papules are usually multiple, and occur either alone or in connection with other lesions. Not infrequently they occur alone and remain papular throughout their evolution, as in lichen planus. In eczema the lesions may be altogether papular or a mixture of papules and vesicles in various stages of development, with scales or crusts. In the small papular syphiloderm, likewise, pustules are often seen intermingled with the papules. On the other hand, in lichen planus, prurigo, lichen scrofulosorum, comedo, milium, urticaria pigmentosa, and xanthoma, papules, possessing for the most part definite form, color, and structure, are observed. Papules are also formed in connection with some of the neoplasmata. It will be remembered that papules are of several distinct varieties, and that some of them are quite unlike not only in form but in their anatomy. They are, however, less numerous in variety than macules; hence if the statement is made that a disease is papular in type and inflammatory, a probable diagnosis may sometimes be reached by the process of exclusion.

VESICLES.

Vesicles are common, and occur in a number of diseases. Vesicular eczema perhaps exhibits the lesion in its most typical state, but it is also observed perfectly developed in herpes, dermatitis herpetiformis, miliaria, sudamen, vaccinia, and varicella. Vesico-pustules are seen in the so-called vesicular syphiloderm, herpes, contagious impetigo, and other affections. Pustules are met with in diseases too numerous and diverse in nature to specify. They occur in marked form in variola, pustular eczema, impetigo, ecthyma, acne, scabies, the pustular syphilodermata, sycosis, herpes zoster, dermatitis herpetiformis, and in other diseases. Pustules and pustular manifestations often occur as complications in various processes not originally pustular. Cutaneous abscesses and sinuses are met with especially in connection with diseases of the sebaceous glands. Vesicles, as has been stated, very frequently pass into pustules, constituting vesico-pustules.

BLEBS.

Blebs, varying in size from a cherry to a goose-egg, are encountered chiefly in pemphigus and allied forms of eruption, dermatitis herpetiformis, herpes iris, erysipelas, syphilis, and leprosy. They are dependent largely upon nerve influence for their production. They are also observed as the result of local irritants, vesicants, scalds, and burns. Wheals are generally significant of a peculiarly sensitive neurotic state of the skin, which inclines to their formation usually upon slight provocation. They are seen most perfectly developed in urticaria resulting from local or internal irritation; they also sometimes occur, more or less pronounced in character, in connection with other diseases, as purpura. They are met with more frequently in children and young persons than in the middle-aged and elderly.

TUBERCLES AND TUMORS.

The tubercle is sometimes merely an exaggeration of the papule, but usually it possesses a life history of its own and is in no way connected with the papule. Its significance is altogether different from that of the papule. It occurs frequently in connection with neoplasmata, and its presence may therefore be indicative of a new growth, benign or malignant in nature. It is seen in tinea sycosis, acne, syphilis, carcinoma, lepra, rhinoscleroma, sarcoma, neuroma, and in other diseases. Tumors may be the result of a simple inflammatory process, but oftener they indicate some new growth, benign or malignant. They may form in sebaceous cyst, epithelial molluscum, fibrous molluscum, erythema nodosum, keloid, angioma, lymphangioma, lymphadenoma, neuroma, lipoma, elephantiasis, syphilis, and in other diseases. In connection with the subject of tubercles and tumors, the diagnosis of the process producing them in doubtful cases may generally be cleared up during life by the microscope. In no other forms of lesions are the results of biopsy, or section during life, so useful and satisfactory.

SCALES, CRUSTS, AND ULCERS.

Scales differ in size, shape, thickness, color, and in other general features, as well as in their chemical composition. In some diseases they are dry, harsh, and brittle, in others soft and greasy. Thus, the scales of psoriasis in typical cases are characteristic; so also are those of seborrhœa of the face, and of tinea versicolor. Scales are exceedingly common, and are observed in a variety of affections; psoriasis, seborrhœa, squamous eczema, ichthyosis, erythematous lupus, and the vegetable parasitic diseases, all exhibit these products more or less typically. They form to a greater or less extent in all the inflammatory diseases; also in other classes of diseases, as, for example, in some of the hypertrophies, as ichthyosis, and in certain atrophies depending on impaired nutrition. Crusts are found as the product of many diseases. They constitute striking lesions in eczema, scabies, ecthyma, syphilis, impetigo, impetigo herpetiformis, dermatitis herpetiformis, herpes, sycosis, leprosy, carcinoma, and scrofuloderma. Ulcers are met with in many diseases, and occur as the result chiefly of inflammation, simple, complicated, or specific. They form in syphilis, lupus vulgaris, carcinoma, leprosy, scrofuloderma, herpes zoster, furuncle, carbuncle, etc.

EXCORIATIONS, FISSURES, AND SCARS.

Excoriations are for the most part met with in those affections which are accompanied by itching and like symptoms; they are seen chiefly in eczema, pruritus, pediculosis, and scabies. Fissures form in eczema, psoriasis, and other inflammatory diseases, and in syphilis and leprosy; also in various hypertrophies, as in ichthyosis, wart, and other forms of epithelial and papillary growth. Cicatrices, slight or extensive, always follow ulceration, the amount of scar tissue depending upon the process and the accompanying circumstances. They also follow certain new growths which are unaccompanied by ulceration, as lupus erythematosus, and certain atrophic affections, as morphœa.

THE MICROSCOPE AND OTHER AIDS.

Microscopic Examination.—The microscope teaches not only the anatomical part of the integument invaded by the disease, whether epidermis, corium, connective tissue, follicles, ducts, or the appendages of the skin, but also the nature of the process. Thus, the degree and the character of the inflammation, whether simple or specific, atrophic, degenerative, and the like, and the presence or absence of parasites, cocci, bacteria, and bacilli, are all points that may be determined.

The value of the microscope in the diagnosis of cutaneous diseases can scarcely be overestimated. The skin is readily accessible to the pathologist, and there is usually no difficulty in obtaining specimens, and in examining the products of disease in the form of epidermis, scales, and crusts; serum, pus, and blood; and the skin itself taken from the living subject. This latter operation (termed happily by Besnier BIOPSY), especially now that cocaine may be employed in the form of hypodermic injection to render the cut absolutely painless, is a simple one that should cause no dread on the part of the patient. With care, scarring may usually be prevented. In doubtful cases of disease the knowledge to be gained from properly prepared sections is often incalculable, the diagnosis frequently becoming clear and certain. This remark is especially applicable to new growths, about whose nature doubt sometimes exists prior to microscopic examination. The so-called vegetable parasites, and other micro-organisms, are made plain to trained eyes under the microscope, and the diagnosis is thus established.

The Magnifying Lens.—The aid of a simple magnifying glass, held in the hand, is in some cases of positive value. The presence of certain animal parasites and their ova; defects in the epidermis, hair, and nail; and various other points, are thereby rendered visible or plainer. Much escapes the unaided eye that may at a glance be obvious through a hand-glass.

Touch.—The trained hand—TACTUS ERUDITUS—is of considerable value in diagnosis. Some diseases may readily be recognized by the touch. Thus, certain varieties of eczema; some cases of psoriasis; acne and follicular affections; ichthyosis and other epithelial hypertrophies; certain atrophies; keloid, molluscum fibrosum, and other connective-tissue growths, such as elephantiasis and the like; and various other diseases characterized by papules, tubercles, and tumors, may all be usually recognized by the hand. Certain crusts also present peculiarities of bulk, consistence, form, shape, outline, distribution, and configuration whereby their nature may generally be diagnosticated.

Sense of Smell.—Some diseases are characterized by peculiar odors, the cognizance of which may aid in establishing the diagnosis. Thus, in bromidrosis, in some exanthemata, and in tinea favosa, the odors constitute notable symptoms. In well-developed untreated cases the mousy smell of the crusts of tinea favosa is usually sufficient to establish the diagnosis.

Subjective Symptoms.—From the character of symptoms of this kind, their investigation is attended with difficulties. They vary in the same disease and in different subjects according to circumstances. The kind of pain or itching, its seat, mode and time of onset, duration, and other peculiarities, are, however, in some diseases characteristic: thus, the neuralgic and burning pain preceding and accompanying herpes zoster is of much diagnostic importance. The pain accompanying many cases of myoma and neuroma of the skin is a striking symptom. The itching of scabies and the itching of dermatitis herpetiformis are both peculiar, and hence are of some value diagnostically. The existence of itching without structural changes in the skin, as occurs in pruritus due to varied causes, is of considerable value in diagnosis, this disease being thereby at once distinguished from eczema, with which it is often confounded.

GENERAL TREATMENT.

GENERAL OBSERVATIONS.

To understand the multitude of manifestations and the diseases affecting the skin requires special study. To treat them successfully calls for skill in diagnosis and knowledge as to the remedies suitable, not only for the disease, but also for the particular variety and stage of the disease present. Upon this latter point I would lay particular stress. This kind of knowledge can come only from close observation and experience.

In the selection of remedies for the treatment of cutaneous diseases, especially those of an inflammatory nature, it must be remembered that the lesions are liable to undergo changes frequently. Sometimes these are varied, and at times are remarkable. This is particularly true of eczema, a disease that at one time shows itself as an erythema with an unbroken epidermis, at another with papular, vesicular, or pustular and intermediate lesions, while not infrequently the condition is that of an excoriated, moist, crusted surface, with varied secondary inflammatory changes, including sclerosis of the skin. To relieve or cure such a disease, then, the different stages and the primary and secondary pathological changes that have occurred in the skin, as well as the patient, and the probable cause of the manifestation, must all be taken into consideration. For these reasons it is impossible to formulate rules for the employment of this or that remedy or formula. It is necessary to treat not only the symptoms but the disease itself, viewed from a rational, scientific aspect. In this way only can satisfactory results be obtained in many diseases. General rules may be given, and they are useful; but the remedies and their strength, and their method of application best adapted for a given case, are matters to be determined largely by experience, including clinical observation under the guidance of a master. Many years ago the author drew attention to the importance of studying cutaneous diseases with the aid of a thorough master,[1] stating that in this way only could the subject be learned satisfactorily. The observation applies with equal force to the treatment of such rebellious diseases as eczema, psoriasis, and acne. The guiding hand of the master in this class of diseases is almost essential to the student in therapeutics. Without experience the remedies and the formulæ cannot be prescribed with much hope of meeting the indications that are obvious to the dermatologist.

It should be the aim of the physician to relieve the disease as rapidly and as effectually as possible. Every means calculated in any way to afford relief to the diseased skin should be employed. No fears need be entertained of curing the disease too soon, or of "driving in the eruption," as this idea is popularly expressed; the danger is rather in temporizing with the affection and thus permitting it to obtain the upper hand. It may be safely stated that the sooner diseases of the skin of all kinds, including the most acute inflammations, are relieved, the better both for the comfort of the sufferer and for the credit of the physician. Careful inquiry and extended experience show that injurious results very seldom if ever follow the cure of these diseases, whether this takes place rapidly or slowly. In many cases the time occupied in the treatment unfortunately extends over a long period, even under favorable circumstances, so that speedy recovery should be regarded with favor. On the other hand, no attempt should be made to "drive out the eruption," with the idea that the cutaneous manifestation is a *materies morbi* which is to be eliminated through the skin. There are many diseases, as, for example, those belonging to the group of glandular affections, where such active remedies as the iodides will readily "drive out," that is, aggravate, the eruption. In like manner eczema may often be aggravated, or "driven out," by the injudicious use of arsenic, this remedy in such cases overstimulating the cutaneous nerves when rest is required. The disease in all such cases is invariably made worse by such improper modes of treatment.

He who would be successful in the treatment of these affections must first acquire a full knowledge of the principles of general medicine; without this groundwork his efforts, in the majority of cases, will at best be rewarded by hap-hazard or unsatisfactory results. Dermatology, rightly viewed, includes the whole integumentary system, and is a department of general medicine. Diseases of the skin in many cases are amenable to the same principles of therapeusis that hold good for disorders of other organs. A simple acute inflammation of the skin calls for the same general plan of management as an acute inflammation having its seat in the mucous membrane. The integument is but a part of the whole organization, and is subject, therefore, to general laws. It is frequently affected manifestly symptomatically, in which case it is an index to the general state, or to some special organ or part affected, the skin disorder being of less importance than the primary disease which has caused it. Diseases of the skin are sometimes reflex in character, and to relieve or to cure these, remedies, as a rule, must be directed against the offending organs rather than against the skin.

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[1] On the Study of Dermatology, Amer. Jour. of Derm. and Syph., 1871.

Before prescribing for a case there are a number of points which should be taken into consideration, some of which may serve to indicate the mode of treatment or the remedies likely to prove serviceable or harmful. These topics may be referred to under the following heads.

Previous History.—Not infrequently the previous history will prove of assistance in determining upon the most suitable method of treatment. It is to be ascertained whether the present manifestation is a first attack or a recurrence. If the latter, the course of the former attack, as well as the nature of the treatment employed, should be inquired into; whether external or internal remedies were employed, and whether they proved successful or otherwise. The preparations used should also, when practicable, be learned from the patient, for a knowledge of past treatment and its results may save both time and trouble. When, for example, we are assured by a patient that arsenic taken internally or tar used externally has on former occasions invariably disagreed, the information enables us to be at least cautious as to the manner of prescribing these remedies should they seem indicated. It will generally be found that in chronic diseases the statement of the patient is correct on such points. Idiosyncrasies, too, it must be borne in mind, are occasionally encountered.

Present General Condition.—The general condition of the patient should be ascertained, and whether there is naturally a tendency to congestion or to pallor of the skin. The state of the circulation should be inquired into, especially as to the hands and feet; also the condition of the glandular systems,—if seborrhœa or moist or perspiring palms are present. The presence or absence of general symptoms, and whether the disease is strictly local or is diffused, should also be ascertained. The state of the alimentary canal should be particularly inquired into. The tongue should be examined, and the patient questioned as to the existence of dyspeptic symptoms and imperfect assimilation. The state of the bowels requires special attention, because in certain diseases, as eczema and acne, the alimentary tract is often at fault and proves by reflex action an exciting cause of cutaneous disturbance. The biliary and renal secretions call for investigation. The condition of the nervous system, so frequently impaired in function, should be inquired into: many affections are well known to be neurotic in origin, and in these cases the treatment must be directed against this system rather than against the integument, if satisfactory results are expected. It will thus be seen that the practitioner must in many cutaneous affections look to the general economy rather than to the skin for the indications of rational treatment.

Nature of the Disease.—Directing attention now to the integument itself, it is all-important to form a definite idea as to the nature of the process present; whether, for example, it is a simple hyperæmia, an inflammation, an hypertrophy, or a combination of processes. The pathological process being identified in a general way, less difficulty will be experienced in the diagnosis, and often the treatment will be indicated.

Duration of the Disease.—The length of time the disease has existed should be ascertained; its natural course studied; whether confined to a small area or diffused, and its tendency to localize or to spread, and whether on the periphery or to crop out at distant points. It is important, also, to determine before prescribing whether it is acute, subacute, or chronic, and, still further, if an acute process, to determine the precise stage. The subjective symptoms should be learned from the patient; whether pain, burning, or itching is experienced, and, if present, the degree of the symptom, and whether continuous, intermittent, or variable.

Cause of the Disease.—The importance of forming a correct opinion as to the cause which has given rise to the affection is so apparent as scarcely to call for mention. Upon a proper interpretation of this point will often depend largely the success or the failure of treatment, especially in such diseases as eczema and acne. It is only by treating the cause, in many cases of inflammatory disease at least, that permanent relief may be looked for. Too much study and investigation can scarcely be devoted to a comprehension of the case as a whole; and let it be remembered that each case demands special study and a plan of treatment adapted to its needs. The lesions themselves, except in the case of local diseases, are often of little consequence compared to the cause, whether it be local or general, which is continually producing new ones; this remark applies particularly to acute inflammatory lesions, as in the case of acne, urticaria, or eczema, depending, it may be, on some internal source of irritation. It is most important in instituting cutaneous therapeutics to discriminate, where possible, between idiopathic and symptomatic disease. When, however, as too frequently occurs, no cause for the disease can be detected, the lesions themselves should be vigorously attacked by every means at hand, with a view of removing them as soon as possible. Sometimes they will recur, but often they do not. In those instances in which the affection is known to be altogether local in its origin, it need hardly be remarked that nothing further than the treatment of the lesions and the removal of the offending cause is called for.

Methods of Treatment.—For the relief or cure of the diseases of the skin, both general and local remedies are demanded, which may be prescribed conjointly or alone, according to the nature of the disorder. Experience proves that in certain cases constitutional or internal treatment is by far the most effective, while in other instances local measures offer not only the best, but at times the only, means of relief: such being the case, it is plain that neither method employed to the exclusion of the other is capable of yielding the best results which it is possible to obtain. It may be said, however, that where external means are sufficient to relieve the disease both promptly and permanently, internal treatment is not only superfluous, but may be productive of harm, as is often noted from the injudicious use of such drugs as arsenic and the iodides. Viewing the subject as a whole, the author is firmly of the opinion that the most satisfactory results in many cases are to be obtained from the conjoint employment of both plans. The affections, and more particularly the individual cases, in which either local or general remedies are to be prescribed, can be determined only by taking into account both the nature and the cause of the disease. No positive rules can be given for the use of either one or another class of remedies, for it will be found that the skin in a state of disorder is a peculiar and often a sensitive organ and is subject to no fixed laws of behavior. The remedy suitable for one stage is frequently not only powerless but often positively injurious in another stage of the disease in the same patient.

Hypodermic Injections.—The value of this mode of therapeusis for the administration of such remedies as arsenic, mercury, antitoxins, animal extracts, and such substances as thiosinamine and the like, may be referred to. In certain diseases where it is desired to make a strong impression on the general system or on the nervous system, arsenic acts more effectively administered by this method than by the mouth, the beneficial results of which, for example, are noted especially in sarcoma and in lichen planus. The value in grave cases of sarcoma of injections of toxins derived from pure cultures of the bacillus of erysipelas has been shown by Coley,[1] of New York, and others. Out of forty-three cases of inoperable sarcoma treated with the toxins by Coley, eleven were what may be termed successful; in some of these relapses occurred in from one to four years. On the other hand, Senn's experience is adverse to this method of treatment, but his cases, it would seem, were not selected. While some carcinomata have yielded to this treatment, in the great majority of cases the results have been unfavorable.

Anæsthetics, Analgesics.—In connection with the topic of hypodermic injections reference may be made to the employment of other methods and agents for the production of local anæsthesia. The condition is brought about for various purposes, but especially for the relief of pain attendant upon operations upon the integument. Since the introduction of COCAINE this drug has been made to serve valuable purposes in preventing and in relieving cutaneous pain, being used chiefly in solution (1 to 4 per cent.) injected beneath the true skin. A few drops injected well into the subcutaneous tissue, at different points around the border of the area of skin to be operated upon, suffice within a minute or two to permit of the removal of a tumor or other formation absolutely without pain. With this treatment all kinds of lesions may be operated upon for purposes of cure or diagnosis. Where the epidermis is defective or wanting, simply brushing the solution or sprinkling a little of the powder over the mucous layer will in a short time produce anæsthesia, but, of course, less profound than if injected into the corium.

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[1] Proceedings of the Amer. Med. Assoc., meeting held at Baltimore, May, 1895.

Vaporization of ETHER and various mixtures containing ether and chloroform have long been in use for producing anæsthesia of the skin; but if the applications are continued too long there is danger of gangrene of the frozen tissues, and there is great pain, especially of inflamed parts, during the freezing. CHLORIDE OF ETHYL is a more active freezing agent than common ether, and often may be used to advantage painted over the surface where superficial anæsthesia only is required. Remedies of this kind, including RHIGOLENE, should be applied for the purpose of benumbing, and not of freezing, the part.

Intracutaneous Injections.—Local anæsthesia may also be produced by making use of various substances in solutions of certain strength injected intracutaneously, according to the method introduced by Schleich, of Berlin.[1] It will be noted that the term intracutaneous is used in contradistinction to subcutaneous. Schleich, as well as Cholewa,[2] E. Martin,[3] Würdemann,[4] and others, has shown that weak aqueous solutions of cocaine (1 to 5000) are able within the limits of the infiltration to produce complete anæsthesia, so that puncturing, cutting, and scraping may be performed without causing pain. Similar results are obtainable in healthy tissue with pure water and solutions of salt, but with the difference that the process of injecting water into the tissue of the skin itself, with the formation of water-lesions, is distinctly painful. Not until from half a minute to a minute after the injection does anæsthesia occur, when it is similar to that after the injection of cocaine solution 1 to 5000 or stronger. Water, therefore, used in this manner produces an "anæsthesia dolorosa," paralysis of the nervous tissue being preceded by hyperæsthesia or pain. Refrigeration of the water to the freezing point reduces this stage of irritation to a minimum. There results an œdema, which, according to Schleich, contains the same amount of common salt (0.6 per cent.) as the serum of the nervous fluids, and in this fact lies the difference between this and ordinary œdema. As strong a solution of common salt as 0.6 per cent. produces no anæsthetic effects worth considering; but a more diluted solution of common salt, as a 0.2 per cent. solution, especially in lower degrees of temperature, produces a speedy anæsthesia in the areas of infiltration. It may also be remarked that what is true of the skin is applicable also to other tissues of the body, as the subcutaneous tissues and the muscles. The 0.2 per cent. solution of common salt produces anæsthesia, proving that it is the infiltration itself that causes the anæsthesia, and that the anæsthetizing fluid need not be in itself anæsthetic; but the process of injection is painful. According to Schleich and Cholewa, the proportion of common salt in a solution is important. Thus, the smallest effective dose of cocaine (weaker injections causing pain) is 0.2 per cent., or 1 to 5000. This aqueous solution of cocaine produces anæsthesia and renders other injections painless. The same dose of cocaine containing 0.6 per cent. of common salt is painful, and is not able to produce anæsthesia, but the same solution of cocaine wherein the amount of common salt is not greater than 0.2 per cent. produces complete anæsthesia. Cocaine and common salt and water are not the only materials that are able in this way to produce anæsthesia in normal tissues, a solution of 3 per cent. sugar, 0.1 per cent. morphia, 3 per cent. potassic bromide, 1 per cent. methyl-violet, 2 per cent. caffein, and others, acting in the same manner, their efficacy being increased by dissolving them in a 0.2 per cent. solution of common salt.

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[1] Schmerzlose Operationen oertliche Betäubung mit indifferenten Flüssigkeiten. Berlin, 1894.

[2] Jour. Amer. Med. Assoc., May 26, 1894.

[3] Therapeutic Gazette, Dec. 15, 1892; also, oral communication to the author.

[4] Jour. Amer. Med. Assoc., Dec. 29, 1894. The author is indebted to Dr. Würdemann's article for suggestions.

The cause of anæsthesia by infiltration is not a simple one, several factors being concerned, the most important of which is removal of blood from the infiltrated tissues by the pressure of the injected fluid. It is caused by the anæmia, the compression, and the cooling. After a properly performed injection the œdematous lesions produced appear white, the foreign fluid occupying the lymph-vessels and areolar spaces, the blood being gradually forced into the neighboring vessels.

While the 0.2 per cent. (gr. i ad ʒi) solution is sufficient to produce complete anæsthesia in normal tissues, the addition of cocaine, morphia, and carbolic acid is demanded where disease exists, but they are employed several hundred times weaker than as commonly used, so that it is possible to keep the doses required to produce anæsthesia below the poisonous limit. The strongest solutions which are used contain only 0.2 per cent. of cocaine and 0.025 per cent. of morphia, so that thirty syringefuls of this anæsthetizing solution may be employed before the maximum dose is reached. For an ordinary surgical operation not more than ten syringefuls are required, and these are used in a manner different from their administration in a single dose; moreover, hardly one-third of this liquid is absorbed. With the cocaine-morphine-salt solution, Schleich finds that the pain after operation is decidedly less than after the use of chloroform.

The anæsthetic fluids employed by Schleich for operation upon highly inflamed or hyperæsthetic areas consist of: cocain. mur., gr. iii; morphiæ mur., gr. ss.; sod. chlorid., gr. iii; aq. dest., ʒiii. This is sterilized and two drops of a 5 per cent. carbolic acid solution are added. For most operations a solution containing less cocaine (gr. iss. to the same amount of solution) is employed, while for superficial operations upon nearly normal tissues a solution still weaker in cocaine and morphia ($\frac{1}{6}$ grain of the former and $\frac{1}{12}$ grain of the latter to the same amount (ʒiii) of solution) is used. After spraying the surface with ether, the injections are made side by side until wheal-like lesions are produced over the line of incision. Only the œdematous region is anæsthetic, and the operation is not to be begun until the artificial œdema is complete. Anæsthesia occurs at the moment of the completion of the œdema. Aseptic precautions are to be strictly adhered to. The solution should be cooled just before the operation by laying the bottle containing it on ice, and be kept cold during the operation; the syringe should also be cooled. As Würdemann states, stress must be laid upon the technique, as localities, however small, that have not been infiltrated retain their sensibility. A certain degree of skill is necessary to make the injections satisfactory, to acquire which experience is required. The details are to be mastered by application to the subject, and the operator must accustom himself to working in œdematous tissues. Schleich has used the method in general surgery with success in several thousand cases, and many others have testified to its efficacy. In excoriated and spongy lesions, as in many epithelial cancers of the skin, the method should not be employed; at least the author has not found it satisfactory in such cases.

Spray.—The treatment of the skin and mucous membrane by means of the spray apparatus is sometimes made use of, and has the advantage of being a neat and clean mode of applying certain remedies. It is especially useful where the disease occupies regions of the body that are with difficulty treated by lotions, ointments, or plasters, as in the case of fissures, where the skin is in folds, and about the mouth, nose, ears, genitalia, and hands and feet.

The following substances in common use are soluble in both ether and alcohol: chrysarobin, pyrogallol, creosote, camphor, chloral, camphor-chloral, iodine, iodoform, salicylic acid, carbolic acid, benzoic acid, citric acid, acetic acid, trichloracetic acid, and corrosive sublimate. In alcohol only are soluble arsenous acid, boric acid, nitrate of silver, acetate of lead, and ethylate of sodium; and in ether only, fats, cantharidin, and collodion.

CONSTITUTIONAL TREATMENT.

Rest.—In some cases rest is an important aid to treatment. In certain inflammatory diseases, as the erythemata, eczema, and psoriasis, as well as in diseases characterized by obvious circulatory disturbance, rest in bed for a few days or weeks will sometimes be followed by good results, especially where judicious local treatment is employed at the same time. The value of this measure applies to certain dermatological cases as forcibly as it does to many cases in general medicine and surgery, the importance of which is generally recognized. The favorable action is in most cases through the nervous system, which thereby is relieved of tension, and the overtaxed vessels are thus permitted to regain strength and tone.

Hygiene, Climate.—The benefits resulting from attention to hygiene are most strikingly seen in cases where the nervous system is disturbed. In this category, also, are to be grouped certain conditions of the alimentary canal which may be benefited by following hygienic rules. The effect of change of climate upon some diseases is occasionally remarkable. In rebellious cases of urticaria, psoriasis, furunculosis, and eczema, for example, the change may be followed by decided and at times even prompt relief. Leprosy and some allied diseases are also benefited by change of climate and residence.

Diet.—The value of a regulated diet in the treatment of certain cutaneous diseases is a matter of considerable importance. A well-directed dietary will be found distinctly useful in some of the inflammatory affections directly or indirectly due to defective assimilation and impaired nutrition. This remark naturally applies to cases rather than to diseases, for, while diet positively influences some cases of eczema and acne, for example, there are other cases, where the disease is dependent upon a neurotic element or upon an internal local or general irritation of some kind, that are not affected by diet. It may, however, be said that the diet should in most cases be directed by the physician. Whether it shall consist largely of meat, or of vegetable or farinaceous food, must depend on the patient rather than on the disease. Upon this point there can be no rule, although it may be said that with the majority of individuals in the upper walks of life the disposition is to err on the side of over-indulgence in nitrogenous food. This is often noted in the case of eczema, psoriasis, and acne in plethoric or gouty subjects, where the tendency to congestion should be reduced by every means at command. In such cases regulation of the diet, including the amount of food consumed, may be essential to a successful result. The proper nutrition of the individual as a whole, with a view to restoring and preserving the equilibrium, the disturbance of which is so often indirectly the cause of disease, should ever be in the mind of the physician. This I believe to be particularly the case as concerns the nervous system, so frequently at fault in many dermatoses. While, therefore, for some cases it may be desirable to restrict such articles as meat, fats, and oils, and to prescribe starchy food, fruits, and acids, for others the diet may advantageously be reversed. In all cases the simplest and most digestible kinds of food should be directed, forbidding such articles as sausage, shell-fish, pastry, cakes, hot bread, cheese, salads, pickles, condiments, acids, acid fruits, nuts, and sweets. Tea, coffee, tobacco, and alcohol are all to be interdicted, or used only under the direction of the physician. Alcohol, especially in the form of fermented liquors and wines, is positively injurious in many of the inflammatory diseases. These articles, being stimulants, retard tissue metamorphosis and functional activity, and hence interfere with nutrition. In some cases excess of starchy food and sugar, especially in pale or strumous children, is injurious, a change of diet which includes fatty food often being beneficial. Good results may sometimes be obtained from a radical change of diet, as in eczema, psoriasis, urticaria, and purpura. In the selection of a dietary suitable for a case in any disease involving nutrition, the needs of the patient should be studied. There can be no rules laid down on this question. The diet should be directed by the physician, but not without consultation with the patient.

Cod-Liver Oil.—This is valuable in those cases where the general health has become impaired through improper or insufficient food, bad hygienic surroundings, and like causes. It is often prescribed to advantage in tuberculous diseases, the scrofulodermata and the like, and in some forms of eczema. In the eczema of strumous children with glandular involvement and a tendency to abscess, it is of particular value.

Sulphur.—This drug, precipitated or sublimed, or in the form of its several compounds, as calx sulphurata, sulphurous acid, sodium hyposulphite, is of value in many affections, including disorders of the sweat and sebaceous secretions, acne, acne rosacea, urticaria, and in some diseases tending to necrosis and suppuration, such as furuncle. SODIUM HYPOPHOSPHITE is an important remedy in urticaria, furuncle, and other diseases, and is worthy of special mention. In suitable cases, especially of the diseases referred to, it is much esteemed by the author in five- or ten-grain doses three or four times a day. ICHTHYOL and THIOL, both containing a certain percentage of sulphur, prove of service in some cases, especially in those where sulphur is indicated.

Antimony.—This drug, used as an alterative in small and repeated doses, is sometimes useful in both acute and chronic affections. In its action it somewhat resembles arsenic. In acute inflammations in robust and congested individuals, especially in such diseases as eczema, psoriasis, and similar forms of inflammation, it may at times be prescribed beneficially in full doses. In small doses it is sometimes of benefit in such affections as chronic lichen planus and in true prurigo. It is not infrequently of value in cases where arsenic is not tolerated, allaying nerve irritability and improving nutrition generally. In these cases, in small doses, it acts as a nerve tonic. Its depressant and toxic effects should be guarded against. The dose varies with the age and the constitution of the patient, the average for an adult being one-thirty-second of a grain of tartarated antimony, equalling about seven and one-half minims of the wine of antimony. It is advisable to begin with less, and to increase the quantity gradually. But where used for its tonic effect on the nerves, the author has obtained most benefit from small doses.[1]

Jaborandi, Pilocarpine.—This drug and its alkaloid are of value for the stimulating impression they are capable of making on the nervous centres, especially on the nervous matter governing secretion. In many diseases where this effect is indicated the drug may be employed, and with the best results in small doses, as in the case of antimony. It may be used in some cases of chronic eczema and psoriasis, in scleroderma and morphœa, and in other diseases in which nutrition is impaired. The dose should, as a rule, be less than is demanded to produce the well-known physiological effects.

Salicylic Acid, Salicylates.—This drug and its salts and preparations, sodium salicylate, salicin, salophen, and salol, may be referred to here, sodium salicylate in particular being of distinct value in erythema multiforme, erythema nodosum, urticaria, eczema, psoriasis, and in other diseases.

Viola tricolor.—This drug (wild pansy), much employed at one time for eczema, has been recommended by Hardy and by Piffard for this disease, especially for the pustular variety occurring in weakly infants and children. It is slightly diuretic, diaphoretic, and laxative, and is best prescribed as an infusion or as a fluid extract. For infants, one drop of the latter two or three times a day may prove sufficient, but for an adult the dose may vary from ten drops to a fluidrachm.

Such remedies as ZITTMANN'S DECOCTION, CHAULMOOGRA OIL, GURJUN BALSAM, and HOANG-NAN, are also made use of as alteratives and nerve tonics in such diseases as chronic syphilis and leprosy, and in other diseases where a radical change in nutrition is desired.

Ergot.—This drug acts by contracting the vessels and thus diminishing the excessive blood-supply to the part. Administered in doses of twenty or thirty minims of the fluid extract, it is sometimes useful in acne, acne rosacea, rosacea, erythema, urticaria, purpura, and pruritus.

Iron.—The preparations of iron must receive mention as being in some cases serviceable. Their administration, alone or in combination with other remedies, is indicated in affections due to a lowered state of vitality, as observed not infrequently in anæmic seborrhœa, acne, and comedo, and in the infectious fevers, as, for example, variola, erysipelas, and the like. Iron cannot be regarded, however, as of positive value in many of the strictly cutaneous diseases, and hence alone is not often prescribed by the dermatologist. But in combating such general abnormal states as anæmia and chlorosis, and to improve the condition of the blood in erysipelas and similar diseases, it is of course of great value, the tincture of the chloride being a very serviceable preparation.

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[1] For further information, see an article by Malcolm Morris, Brit. Med. Jour., 1883. W. Allan Jamieson and Jonathan Hutchinson have also directed attention to the value of the drug in cutaneous medicine.

Quinine.—This may be given with advantage in many diseases, as, for example, in certain of the erythematous inflammations, as chronic urticaria and erythema multiforme, erythema nodosum, erysipelas, and in elephantiasis, especially in countries where that disease is endemic. It is of value in the neuroses, as in pruritus, and in other diseases dependent upon or complicated by nervous disturbance, as lichen planus; also in diseases accompanied by a malarial element, as in some cases of urticaria.

Arsenic.—As is well known, arsenic has long been held in high esteem as a remedy in cutaneous medicine. At the present day there exists some diversity of opinion concerning its worth as a therapeutic agent against this class of diseases. Many dermatologists believe they derive a great deal of good from its employment in a number of affections, while others of equal experience are inclined to place but little reliance upon its curative powers. The indiscriminate employment of the drug is to be deplored. To use it in diseases affecting the skin solely because the skin is diseased, without reference to the nature of the affection, to the stage of the process, or to the patient, as is so frequently done, is to be deprecated. The lack of success and the positive injury often done to the whole system by such injudicious treatment have brought the drug unjustly into disrepute with some. I hold that it is a remedy of great value; that it is, in fact, by far the most valuable of all internal remedies in the treatment of many dermatoses. The cases, however, in which it is prescribed must be selected, if successful results are to be expected. To say that arsenic is of use in "diseases of the skin," viewed collectively, is to make an assertion so vague and meaningless as to be of no practical value. It is necessary to specify not only the disease, but also the stage of the affection, and, what is even more important, to select a suitable subject, if we would employ it successfully. Arsenic should be used to improve the general condition causing the disease, rather than against the lesions.

MODE OF ACTION.

Its action is through the central nervous system and the nerves. It is a direct nervine stimulant. Caution should always be observed in its use. Unless the case be suitable, it will generally aggravate the disease. In a general way it may be said that it is most useful where the tone of the nervous system is lowered or depressed.

Ringer, Murrell, and Nunn[1] found that when frogs were poisoned by arsenic the cuticle could be readily stripped off the whole body within a few hours after the administration of the drug. The general effect of arsenous acid upon the epidermis is to cause a degeneration and partial solution of the protoplasm of the cells, the whole epidermis becoming loosened from the true skin, and the cells of the rete Malpighii being incoherent, so that the whole layer breaks down. In other cases the nerves governing the formation of pigment are so over-stimulated that increased deposit of pigment occurs, characterized by yellowish, brownish, or blackish discoloration in the form of spots and patches, or by dryness or desquamation of the epidermis.

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[1] Jour. of Physiology, vol. i., No. 4.

Arsenic exerts its influence chiefly upon the mucous layer of the epidermis. Hence it is found that diseases involving the more superficial parts of the skin are, as a rule, most benefited by its administration. It possesses but little power over many affections which have their seat in the deeper structures. When administered two or three times a day, its action upon the skin is often slow, several weeks often being requisite to produce the desired result. Given in small doses often repeated, however, say a half or one minim of liquor potassii arsenitis every hour or two, its effect upon the system may be speedily obtained, sometimes within forty-eight hours. Improvement once having been obtained, it is generally expedient to allow the patient to continue its use for some weeks after all symptoms of disease have disappeared, usually in smaller doses. It should not be given in the acute inflammatory stage of any disease of the skin, as a rule. It should not be prescribed when there is great heat, burning, intense itching, or rapid cell change. It is not only of no good at this period, but is often positively injurious, tending to augment the activity of the morbid process. It stimulates the mucous layer when rest is demanded. In many cases it increases the congestion of the skin and the itching. Its administration, in whatsoever disease, should in almost all cases be withheld until the acute symptoms have subsided. The more general the cutaneous disease in its distribution, the more likely is it to prove beneficial. In localized patches, as of psoriasis, eczema, or lichen planus, dependence for the cure should be placed mainly upon local remedies. The general condition of the patient, rather than the particular cutaneous manifestation, should be the guide for its use.

DISEASES IN WHICH ARSENIC IS USEFUL.

It is unquestionably of great value in psoriasis; but it is by no means of benefit in every case, nor should it be directed in all stages of this disease. Where the process is active and attended with intense hyperæmia, especially in so-called acute psoriasis, as a rule, it increases the already highly inflammatory condition. The more active the cell proliferation the less probability is there of its being beneficial. On the other hand, the paler and the more indolent and sluggish the process the greater the chance for improvement. It may be stated that in most cases it should be withheld until the morbid process has become settled in its course.

It is of service in certain varieties and forms of eczema, especially papular and squamous manifestations; particularly in those cases where the primary lesions are ill defined and where there is but slight infiltration of the skin. Certain persistent localized papular and abortive vesicular eczemas, as frequently seen, for example, about the fingers, sometimes yield to it. Chronic infantile eczemas, unaccompanied by digestive disturbance, are at times favorably influenced by the remedy. But in infants it should never be prescribed unless there are good reasons for its administration. It is a drug capable of doing too much damage to the nerves and to the economy as a whole to be prescribed unless plain indications exist for its employment. As is well known, children tolerate relatively large doses. Viewing the subject in a broad light, it may be stated that too much should not be expected of arsenic in eczema. Many cases are in no degree improved by its use, and some, on the contrary, are unquestionably aggravated.

Pemphigus is often permanently relieved by its judicious use. Experience has shown it to be of great value in many, but not in all, cases of this disease. It seems to be less efficacious in the foliaceous than in the common variety. Discrimination must be made between pemphigus and pemphigoid eruptions, in which latter forms of disease it may not be called for. In lichen planus and in lichen ruber it is also often prescribed with great advantage, but its effects in these diseases are somewhat variable. It should not be administered in acne unless distinctly indicated. It is of less value in this disease than in any other dermatosis against which it is commonly employed. In certain forms of acne, however, especially in chlorotic or anæmic subjects where the lesions are very numerous and of a fine papular character, its administration is occasionally followed by good results. In chronic urticaria and in some cases of furunculosis it proves serviceable; likewise in gangrene, especially in hospital gangrene, beginning with small doses every two hours and rapidly increasing, combined with alcohol as a stimulant.

PREPARATIONS OF ARSENIC.

The preparations employed are arsenous acid, bromide of arsenic, sulphide of arsenic (realgar), arsenite of quinine, liquor arsenici chloridi ("De Valangin's solution"), liquor sodii arsenatis ("Pearson's solution,") and liquor potassii arsenitis ("Fowler's solution"). Arsenous acid is a good form in which to administer the drug, given in pill form, usually combined with sugar of milk. It may also be combined with black pepper and powdered liquorice, constituting the so-called "Asiatic pill," employed more often in Europe than in the United States. The following is the formula somewhat modified: Arsenous acid, one grain; black pepper and liquorice powder, of each twenty grains, with a sufficient quantity of mucilage; mix, and divide into twenty pills. S.—One to be taken two or three times a day, directly after meals. The strength of the pill may, of course, be varied to suit the case. "Boudin's solution" (an aqueous solution with white wine) may also be prescribed. The aqueous solutions do not keep well: hence these preparations should always be dispensed freshly prepared.

The liquor potassii arsenitis may be given combined with a bitter tincture, wine of iron, or an elixir of calisaya bark. Prescribed in this way there is less likelihood of gastric and intestinal derangement. Where this occurs the drug should be discontinued. Under these circumstances it may be advisable to change the preparation; thus, for Fowler's solution to substitute the solution of arsenate of soda or arsenous acid. The mode of ordering the solution pure and directing so many drops to be taken at each dose is objectionable. The average dose suitable for the majority of individuals is three minims. Four, six, or eight minims, and even larger doses, will often be tolerated, but out of a number of persons comparatively few will be able to take more than three or four minims for any length of time without systemic derangement. Tolerance of the drug may generally, but not always, be acquired, sometimes to a remarkable degree, as in confirmed arsenic eaters. The solution of chloride of arsenic is prescribed in about the same dose as Fowler's solution. The liquor sodii arsenatis is more stable, milder, and less irritating to the intestinal tract than Fowler's solution. The sulphide of arsenic is also well tolerated, and the same may be said of the arsenite of quinine. Arsenic should always be given either with the food or directly afterwards. Used hypodermically it has been found of value especially in lichen planus, psoriasis, lymphadenoma, sarcoma, and glandular affections. The dose at first should be small, say one minim of Fowler's solution diluted with fifteen minims of water. Antiseptic precautions should be instituted. Abscesses are liable to occur, and the operation may cause some pain. The toxic effects of the drug should always be watched for and guarded against. Occasionally they appear insidiously, especially in the form of multiple neuritis. Idiosyncrasies are liable to be met with, some of which are striking. The author has met with individuals in whom fractional doses of a drop of Fowler's solution invariably produced marked toxic symptoms. Some of the injurious effects resulting from the use of arsenic will be referred to elsewhere, under dermatitis medicamentosa.[1]

Phosphorus.—The dermatoses in which this drug may be prescribed are those in which arsenic is indicated. It is a nutritive stimulant to the nervous system. It is not, however, well tolerated, and it is partly on this account, probably, that the views of observers as to its efficacy are conflicting. It has been used with success occasionally in psoriasis and eczema, and in lupus vulgaris and similar diseases. It is best administered in the form of tincture or elixir, or of phosphorated oil enclosed in capsules, the dose being one-hundredth to one-fiftieth of a grain. J. Ashburton Thompson's solution, which is one of the best formulæ for the administration of phosphorus, is as follows: Take of phosphorus, grain i; absolute alcohol, drachms v; dissolve with the aid of heat and agitation, and then mix, while still warm, with the following mixture, also warmed: glycerin, ounces iss.; alcohol, drachms ii; spirit of peppermint, minims xl. One fluidrachm of this solution contains one-twentieth of a grain of phosphorus, and the dose in the beginning is ten drops three times a day, taken after meals in water quickly added, increasing daily in dose until thirty or forty drops are reached, if it agrees with the stomach. L. D. Bulkley, of New York, endorses the formula, and states that he has derived undoubted benefit from the remedy. The elixir of phosphorus of the National Formulary of unofficial preparations is also an eligible preparation. Zinc phosphide, in doses of one-twentieth to one-eighth of a grain, may be employed with benefit in suitable cases, as in some cases of herpes zoster. To obtain its effect speedily, the dose should be given in small doses every hour or two, disturbance of the alimentary tract and toxic effects being watched for. A pure and fresh drug should be insisted on.

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[1] The value of arsenic in skin diseases has been ably considered by Bulkley, in a monograph entitled "The Use and Value of Arsenic in the Treatment of Diseases of the Skin," New York, 1876, and "The History and Therapeutic Value of Arsenic in Skin Diseases," Practitioner, 1880; also by E. L. Keyes, "The Useful Administration of Arsenic in Diseases of the Skin," Jour. of Cut. and Ven. Diseases, 1886, p. 230; and by Hardaway, "The Question of the Value of Arsenic in Diseases of the Skin," Jour. of Cut. and Ven. Diseases, 1886, p. 233.

Tar, Carbolic Acid.—Both of these substances are at times employed internally with good result, as in erysipelas, psoriasis, eczema, and pruritus. Tar, in five- or ten-grain doses, is sometimes useful in chronic eczema and psoriasis. It should be ordered in pills or capsules. It is milder in its action than carbolic acid. Carbolic acid, in pill form, one or two grains three or four times a day, is useful in specific fevers generally, and in various other microbic diseases. It may also be administered in a mixture containing a few drops of chloroform. It tends to arrest febrile disturbance, and may be given until the urine becomes smoky or dark.

Mercury.—The preparations of mercury are used not only for the manifestations of syphilis, but also for other dermatoses. Thus, minute tonic doses of corrosive sublimate, alone or with bark, are sometimes taken with benefit in certain chronic inflammatory diseases accompanied with thickening, as, for example, eczema. In syphilitic diseases they are, of course, invaluable. The corrosive chloride, protiodide, biniodide, mercurial pill, and gray powder are the forms in which it is commonly prescribed, the corrosive chloride and the biniodide being preferred by the author. Its administration by inunction is also of great value. Mercurial ointment may often be advantageously weakened with petrolatum. The effect of the mercurials upon the system should always be carefully noted, and in no case should they be given until active ptyalism has been produced. Mercury, especially the biniodide, is combined most advantageously with iodide of potassium, not only in syphilitic but also in other diseases. Here may be mentioned "Donovan's solution" (liquor arseni et hydrargyri iodidi), a remedy of repute in the treatment of syphilitic manifestations, and also in certain chronic non-syphilitic affections accompanied with infiltration of the skin.

Iodides.—These find their chief use in scrofuloderma, lupus vulgaris, lupus erythematosus, and the syphilodermata, but they are useful in many other diseases. Not infrequently they are of service in small doses,—half a grain or a grain,—as an alterative, when larger doses would prove injurious. In the affections mentioned these may be administered, either alone or in combination with mercury, in doses varying from two to fifteen or thirty grains, and occasionally even in larger doses, largely diluted with water. When used in non-syphilitic diseases the dose should generally be small, although in psoriasis, for which it is sometimes prescribed with benefit, good results, as a rule, do not follow until large doses have been employed. Iodidized starch is a mild preparation, sometimes used in syphilis and in lupus erythematosus, in doses of from one to four drachms, administered in water or water-gruel. It must be remembered that the iodides, as well as the bromides, are capable of producing varied forms of eruption.

Analgesics.—Such drugs as chloral, bromide of potassium, acetanilide, and phenacetine are employed to relieve nerve pains, as in herpes zoster and dermatalgia, and in pruritus. They are also sometimes used in eczema and lichen planus, and in other diseases accompanied with violent itching. Opium and morphia are seldom prescribed, because they tend to bring on itching. They are employed, however, to relieve great or continuous pain, such as occurs in carcinoma.

Alkalies.—These find their employment in the acute and chronic inflammatory dermatoses, such as the erythemata, eczema, psoriasis, acne, and acne rosacea, especially in those cases where a manifest rheumatic or lithæmic state exists. In erythema multiforme and erythema nodosum they are sometimes distinctly useful, liquor potassæ, and the carbonates of potassium, sodium, and lithium, all being employed.

Diuretics.—Remedies exerting an eliminating influence upon the kidneys are sometimes administered with advantage in highly inflammatory diseases complicated with defective excretion, as, for example, in some cases of eczema and psoriasis. Saline, non-stimulating preparations are preferable, the citrate, acetate, and bicarbonate of potassium, in from ten- to twenty-grain doses, being those from which most relief is usually to be derived. The waters of certain springs that possess but few solid constituents, such as the Poland Spring and the Cresson Magnesia Spring, may also be used with advantage, in all cases taken on an empty stomach one-half or three-quarters of an hour before meals. The condition of the urine, especially in the acute inflammatory diseases, should always receive attention, not only as to the presence of albumen and sugar, but also as to the amount of saline constituents. Remarkable deviations from the normal, indicating the use of diuretics, are sometimes met with.

Purgatives.—This class of remedies is of service in many of the inflammatory diseases. Saline purgatives, especially the sulphates of magnesium and sodium, cream of tartar, and Rochelle salt, are to be recommended, and may be given with marked benefit in the early stages of many of the acute inflammatory diseases. Magnesium sulphate is the most valuable of these salts, and is frequently employed in suitable cases of eczema, acne, and the like, where salines are indicated and well borne. In some cases they cause considerable general disturbance in the alimentary tract, when their use should at once be discontinued. The purgative natural mineral waters, including the so-called "bitter waters," may also be employed with advantage. All remedies of this kind, however, should be used with discretion, and never to the extent of violent purgation. Magnesium sulphate especially is useful when prescribed with other substances, as, for example, iron, acids, and barks, in the form of a draught, as in the "mistura ferri acida" and like preparations. This mixture, much employed in Great Britain and in the United States, is variously prescribed, but the following formula is usually well tolerated by the stomach, and is effective where a tonic acid saline aperient is indicated: Magnesium sulphate, ℥iss.; dilute (or aromatic) sulphuric acid, ʒi; sulphate of iron, gr. viii; peppermint water, ℥iv. The dose is one tablespoonful in a gobletful of water half an hour before breakfast. The effect is laxative, movement occurring usually only once a day, an hour after taking the mixture. Sometimes syrup of ginger is an ingredient; for other cases infusion of quassia may be substituted for the peppermint water. All purgatives and mixtures of this kind should invariably be administered on an empty stomach, and at least a half-hour before eating; in many cases they are prescribed most advantageously once a day, before breakfast, in others three times daily, before each meal, in smaller doses. The aperient rather than the purgative effect of such remedies is often indicated.

Natural Mineral Waters.—These, especially those possessing laxative, diuretic, diaphoretic, and tonic properties, are at times taken with benefit, but the cases as well as the diseases must be selected if good results are to be expected. Speaking broadly, it may be remarked that their value in cutaneous diseases generally cannot be considered great. But, on the other hand, it must be said that the *modus operandi* of natural mineral waters is not well understood, and that consequently they are often grossly misused. The author holds the belief, based upon experience, that they should be prescribed generally with the view of operating against general conditions of the system at large rather than against definite cutaneous lesions. There are exceptions to this statement, however, as in psoriasis and in some forms of eczema and the like, in which cases used in bathing as well as drinking, but especially in bathing, the waters may act happily.

Reference may be made to a few of the well-known springs of the United States and Europe, classifying them according to their chief constituents or their characteristics.[1]

The SULPHUR OR SULPHURETTED WATERS contain various sulphur compounds and gases, especially sulphuretted hydrogen. They vary considerably in their composition; some contain large proportions of calcic carbonates ("calcic-sulphur waters"), others, chloride of sodium in excess of other salts ("saline-sulphur waters"). Those containing carbonate of lime and sulphate of lime are generally constipating; those containing sulphate of sodium or of magnesium or large proportions of sodium chloride are usually cathartic. Richfield Springs, Sharon Springs, and Avon Springs, in the United States, Harrogate, England, Strathpeffer, Scotland, Luchon, Aix-les-Bains, and Barèges, France, are all well-known "sulphur waters." Most sulphur waters are alterative and diaphoretic; some prove exciting, some sedative, others depressing. Some of them interfere considerably with digestion and assimilation, and are otherwise not well tolerated. In many cases they prove more valuable used as baths than internally. In the Richfield Springs waters the amount of sulphuretted hydrogen is unusually large, and their efficiency is probably due to this fact. More dependence is to be placed upon the external than upon the internal use of these waters. In some cases they produce disturbance of digestion, and their tendency is to constipate.

The CALCIC WATERS contain the salts of lime, especially the sulphate (gypsum) or carbonate (limestone), frequently together, with more or less carbonic acid gas. They are diuretic and diaphoretic. The waters of Contrexéville, France, are, in addition, laxative and excitant, and are well tolerated in large doses. The Sweet Springs of West Virginia, and Waukesha Silurian Spring, Wisconsin, may also be mentioned as examples of these waters.

Some of this class of waters, especially those showing upon analysis comparatively few solid constituents, are also DIURETIC WATERS; but the latter constitute a group by themselves, their characteristics being the notable paucity of salts of any kind. They are usually light and agreeable waters. Some of the calcic waters are markedly diuretic. Thus, the Poland Spring, of Maine, Cresson Spring, Pennsylvania, and Waukesha Silurian Spring, Wisconsin, are distinctive examples of such waters, and there are other springs whose waters are similarly constituted. Because of the small quantity of solid constituents they contain, they may be designated PURE WATERS. They often serve a useful purpose in washing out or cleansing the emunctories, and in some cases may be used to advantage in eczema and psoriasis, as met with in large, plethoric persons, in those of sedentary habits, and in bon-vivants.

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[1] The natural mineral waters of the United States have been investigated in particular by a committee of the Amer. Med. Assoc., consisting of Drs. Wm. Pepper (reporter), H. I. Bowditch, A. N. Bell, S. E. Chaillé, and Chas. Denison. See Transactions for 1880.

Excellent work has been done by A. C. Peale, " Lists and Analyses of the Mineral Springs of the United States," Government Printing Office, Washington, 1886; also "The Natural Mineral Waters of the United States," Department of the Interior, U. S. Geological Survey. J. W Powell, Director. Washington, 1895. A fine map showing the location of the natural mineral-water springs of the United States accompanies the latter monograph.

The reader may also consult with advantage the well-known treatises on the "Mineral Springs of the United States and Canada," by G. E. Walton, Third Edition. New York, 1883, and the "Mineral Springs of North America," by J. J. Moorman, Philadelphia, 1873; and an article on "The Real Value of Mineral Waters in Diseases of the Skin," by L. D. Bulkley, in the Medical Record, Jan. 4, 1890.

As examples of the ALKALINE WATERS, in which the chief ingredients are the alkaline carbonates, especially sodium carbonate and the carbonates of calcium and magnesium, and sodium chloride, together with a variable amount of carbonic acid gas, Vichy (Grande-Grille), Vals, Royat, Carlsbad, and Ems, in Europe, and Saratoga Vichy, and Ojo Caliente, New Mexico, in the United States, may be mentioned.

An artificial "Carlsbad salt" may be prepared according to the following formula, recommended by Otto Leichtenstern:[1] Crystallized sodium sulphate, ʒv; sodium carbonate, ʒii; sodium chloride, ʒi. Where increased peristaltic action is desired, a larger proportion of sodium sulphate may be added to the formula. As a substitute for the well-known alkaline-saline Ems water, a formula consisting of 2 parts of sodium bicarbonate and 1 part of sodium chloride, one teaspoonful of which is to be dissolved in a quart of water, may be given.

SALINE WATERS contain chiefly sodium chloride, but a special group contains, in addition, the sulphates of sodium and magnesium in large amounts. The latter are the so-called "bitter waters." To the first group belong some of the Saratoga waters, especially Congress Spring, and St. Catherine's Spring in Ontario, Canada, and in Europe, Kreuznach, Homburg, Kissingen, and Wiesbaden. The BITTER WATERS, in addition to the sodium and magnesium sulphates, contain the carbonates of lime and magnesium and the sulphate of calcium. The noted Pullna water of Bohemia, and the Hunyádi-Janos, Franz-Josef, Æsculap, and Rakoczy of Hungary, may be taken as types. The Franz-Josef (Ofen) bitter water is very closely represented by equal parts of magnesium sulphate and sodium sulphate. An artificial Hunyadi-János water may be imitated according to the following formula: Magnesium sulphate, 225 grains; sodium sulphate, 262 grains; sodium chloride, 7½ grains; water, Oi. Friedrichshall water may be imitated as follows: Sodium sulphate, 105 grains; magnesium sulphate, 75 grains; sodium chloride, 60 grains; magnesium chloride, 30 grains; water, Oi. The Hathorn Spring, Saratoga, and Crab Orchard Spring, Kentucky, belong to the same group, although they are not so strong in solid constituents as the foreign waters referred to.

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[1] Ziemssen's Hand-Book of General Therapeutics, vol. iv., London, 1885, p. 440.

As examples of CHALYBEATE WATERS, those of Rawley Springs, Virginia, Sharon Chalybeate Spring, New York, Schwalbach, Germany, and Spa, Belgium, may be mentioned. They prove useful sometimes in acne and seborrhœa, and in neurotic eczemas occurring in anæmic, spare, overtaxed women.

Among the strongest of the ARSENICAL WATERS are those of La Bourboule, in France, and of Levico, in the Austrian Tyrol; but the results from their employment, according to my experience, are not so marked or beneficial as might be expected from such strong waters. They should be used at the springs rather than from bottles.

Mineral waters should always be taken a half-hour or longer before meals, and drunk slowly. Much of the benefit accorded to the proper use of saline mineral waters is probably due to the mild purgation which accompanies their introduction into the alimentary tract. Laxative and purgative saline waters stimulate the nerves of the stomach and intestines, and thus excite reflexly peristaltic movements, aid the removal of accumulated products, and in consequence improve digestion and assimilation.

Animal Extracts.—There are other agents of an entirely different kind which have been found to be of service in various and diverse diseases of the skin, among which are the extracts of certain organs, as the brain and the various glandular bodies of the lower animals. Of these the THYROID GLAND of sheep and other animals, variously prepared, in the form especially of a glycerin or a desiccated extract, may be especially referred to. It has been proved that this drug acts favorably in some cases of lupus vulgaris, ichthyosis, psoriasis, and chronic, intractable eczema; also in fibroid formations and in scars. The drug, however, as the author's experience has shown, must be used with caution, on account not only of the febrile reaction but also of symptoms of other systemic disturbance, such as flushing, giddiness, forgetfulness, depression, melancholia, and palpitation, and sometimes the insidious formation of deep-seated abscess. The dose varies from one to five grains once or twice daily or less frequently. It should in all cases be small at first, the amount being gradually increased from week to week. Symptoms of general disturbance should be watched for, and when they occur the use of the remedy should be suspended for a time.

THIOSINAMINE and TAURINE, administered hypodermically, from half- to three-grain doses, are occasionally made use of with benefit in such diseases particularly as lupus, and also in certain cases of the simpler but intractable inflammatory diseases, such as eczema, psoriasis, and acne.[1]

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[1] Dr. S. G. Dixon has observed several well-known cases of inveterate lupus and acne where these remedies acted favorably within a short period and with remarkable efficacy.

Preparations made from the bacillus tuberculosis, such as the so-called "Koch's lymph" or "tuberculin," and the like, are occasionally employed hypodermically, therapeutically, and for diagnostic purposes, in tuberculosis; but, although decided benefit sometimes follows their use in lupus vulgaris and other conditions, they are too uncertain and dangerous in their action to be used for ordinary cases.

LOCAL TREATMENT.

External remedies are used with the view of relieving or of curing the disease. For the majority of diseases they constitute the most valuable, and for some the only satisfactory, means. They are especially useful in the many local and localized affections to which the skin is prone, and are made use of in one form or another for almost all cutaneous manifestations. They are, of course, very numerous, and include a great variety of substances, which are employed either alone or, more often, in combination, and according to certain methods or with special appliances.

There are many drugs that find employment in the local treatment of cutaneous diseases, some of which are of such importance as to merit special mention. They are used in a variety of forms, as powders, ointments, pastes, or lotions, and in the form of special media. The subject of local treatment may be considered under the following captions.

Powders.—Simple, innocuous substances, chiefly in powder form, are employed in ointments, pastes, lotions, and as dusting-powders. Of these, wheat-starch, corn-starch, rice, Venetian talc, kaolin, oxide of zinc, oleate of zinc, stearate of zinc, carbonate of zinc, calamine (an impure carbonate of zinc, brownish-pinkish in color), carbonate of magnesium, chalk, silicate of magnesium, subnitrate of bismuth, carbonate of bismuth, oleate of bismuth, orris root, and lycopodium, may be mentioned. OXIDE OF ZINC is the most generally useful in this list, and serves as the basis of the well-known oxide of zinc ointment and oxide of zinc paste. Carbonate of magnesium is of value especially as an absorbent dusting powder. Both oxide of zinc and calamine are much used in acute erythematous conditions in the form of aqueous lotions, the powders being held in suspension. The color of calamine varies, but as ordinarily met with equal parts of that drug and oxide of zinc produce the flesh tint.

Stimulating and germicidal drugs in powder form may sometimes be employed with benefit, as, for example, calomel in chancre and other ulcerative lesions. The fumes of sublimed calomel are also of value in ulcerative lesions in which mercurials are indicated. Aristol, iodoform, acetanilide, and many other drugs may be used for similar purposes.

Fats and Oils.—The oils and fats made use of are lard, suet, lanolin, adeps lanæ, glycerin, cod-liver oil, olive oil, almond oil, walnut oil, cacao butter, spermaceti, petrolatum, and the numerous other petroleum products, variable in composition and consistence.

LANOLIN is a useful addition to the list of fats which may be employed as ointment bases, but its penetrating, peculiar sheepy odor is somewhat objectionable. This, however, may be in a measure overcome by employing it with other fats and oils and with perfumes. It contains a large percentage of water, will take up additional water, and consequently is of value where an evaporating, cooling ointment is called for. Lanolin when entirely freed from its water proves irritating in some cases, by abstracting water from the skin. Lanolin does not dissolve chrysarobin, nor does it subdivide mercury finely enough to be valuable for employment with this drug. The different petroleum ointments, as petrolatum, vaseline, cosmoline, etc., unless properly manufactured and freed of impure paraffin oils, may irritate some skins.

ADEPS LANÆ (similar to but different from lanolin) is recommended by Unna and others as a substitute for lanolin, the writer named preferring it to lanolin. The objectionable free chlorine which some investigators state to exist in it Unna and Mielck have not been able to find. The following formula makes a soft, creamy, desirable ointment: Adeps lanæ, 10 parts; oil of sweet almond, 10 parts; orange flower water, 20 parts. The water of orange flower disguises the odor of the adeps lanæ better than most perfumes, so that this ointment is not objectionable on this account. The odor of adeps lanæ is not so sheepy and penetrating as that of lanolin. Unna gives the following ointment, which he calls "cremor refrigerans:" Lanolin, 10 parts; lard, 20 parts; rose water, 60 parts. The formula makes a soft, creamy ointment,—too soft for most purposes unless zinc oxide or other powder be incorporated with it.

GLYCERIN is a poor excipient for drugs that are to be absorbed by the skin. It does not penetrate the skin, and therefore where penetration is needed it does not take the place of lard or oil. On the other hand, where only a local effect of the drug is called for, as in the case of parasiticides, and where systemic effect is to be avoided, as in the use of corrosive sublimate, it is to be preferred.

Sulphur, Resorcin, Tar.—Substances and drugs containing sulphur, and products derived from the coal and wood tars, such as sublimed and precipitated sulphur, hypochloride of sulphur, potassium sulphide, sulphurous acid, sodium hyposulphite, resorcin, ichthyol, thiol, naphtol, hydronaphtol, tar, oil of tar, oil of cade, oil of birch, creosote, carbolic acid, oil of turpentine, and creolin, are all used. Some of these may be considered specially.

SULPHUR is of great value not only as a parasiticide, as in scabies and tinea versicolor and the like, but also in affections of the sebaceous glands, particularly in acne, comedo, and seborrhœa, as well as in other diseases. It is a "keratoplastic," or "reducing," agent, withdrawing oxygen from the tissues and favoring the cornification of epithelium. In strong doses, however, it destroys epithelium. Its action is similar to that of resorcin, pyrogallol, and chrysarobin. In contradistinction to this class of remedies the so-called "keratolytic," or "oxidizing," agents, as typified by corrosive sublimate and the chlorine compounds, may be referred to.

ICHTHYOL is derived from a bituminous mineral, rich in the fossilized remains of fish and marine animals (hence its name), found in Southern Europe, particularly in the Tyrol. The dry distillation of this mineral yields an oil containing about ten per cent. of sulphur in chemical combination, which by treatment with sulphuric acid becomes a sulphonate. By neutralization of the latter with alkalies the corresponding ichthyol salts are obtained, of which the principal are ichthyol-sodium and ichthyol-ammonium,—the former generally passing under the common name of ichthyol. Ichthyol is of service in burns, erysipelas, lymphangitis, certain forms of eczema, leg and other ulcers, and in other diseases, employed as a solution or an ointment. THIOL is similar to ichthyol in its properties, and is comparatively odorless.

RESORCIN.—This is a useful remedy, and may be employed in such diverse conditions as seborrhœa, especially of the scalp, and epithelial neoplasms. In seborrhœa of the scalp, in the strength of from ten to twenty grains to the ounce, in ointment or lotion form, with or without glycerin, it is of value. In sebaceous gland degeneration and in the milder forms of epithelial cancer which occur so commonly about the nose, cheeks, and forehead, used as a caustic, twenty-five or fifty per cent. strength with plaster, it is distinctly valuable. It oxidizes upon exposure to the air, like pyrogallol and some other substances of this group, becoming brownish, and stains the skin more or less deeply, according to the strength employed. It is a stronger and more stimulating remedy than sulphur.

Resorcin, like sulphur, but in a more marked degree, has a double action on the skin: in weak strength it is keratoplastic,—that is, it tends to harden the skin by favoring cornification of the epidermis; and employed in strong solution it is keratolytic, macerating and destroying the skin. It may be considered in its action on the skin as belonging to the class of remedies known as "reducing agents," exhibiting that form of chemical action.

TAR (pix liquida) is one of the most valuable of remedies in squamous eczema and psoriasis, acting as a stimulant and constrictor to the cutaneous capillaries; but it is not tolerated by all skins, and hence it should be prescribed discreetly, and at first weak. It is employed as an ointment, from one-half drachm to two drachms to the ounce, and in the form of lotion and emulsion. The official tar ointment is too strong for most cases, at least of eczema. A better preparation, useful in subacute patches of eczema, consists of: Tar ointment, ʒii; zinc oxide, ʒss.; cold cream ointment, ʒvi. The oils of tar, as OIL OF CADE and OIL OF BIRCH, may be used advantageously with alcohol, and with alcohol and ether, as in the following formula, which dries rapidly upon the skin: Oil of birch, 10 parts; alcohol and ether, each, 15 parts; spirit of lavender, 5 parts. Tar, oil of cade, and oil of birch may be advantageously employed with collodion, half a drachm or one drachm to the ounce, and in this form are especially useful in localities where other applications are difficult to retain in place. In employing tar with collodion, the contractile and not the flexible must be used, as the latter is too oily and does not adhere satisfactorily. OLEUM RUSCI is a product of the bark of the white birch (betula alba) by dry distillation. Its odor resembles that of Russia leather, and is less disagreeable than that of oil of cade or of oleum fagi. The crude oil (oleum rusci crudum) is preferable. The Russian is quite different from the Dutch and the German oil.

CREOSOTE.—This is a product of the distillation of wood-tar. It much resembles carbolic acid in its properties. It acts upon the cutaneous sensory nerves as an anæsthetic, and may be used in diseases where carbolic acid and tar are indicated; but its penetrating, smoky, disagreeable odor is an objection against its use for ordinary cases. It may be used as an ointment in the strength of from ten grains to one drachm, or even more, to the ounce; also in the form of creosote-water, one per cent. strength, though it does not make a perfectly clear solution. It is soluble in all proportions in absolute alcohol, ether, chloroform, acetic acid, benzin, and in the fixed and volatile oils.

Of the BALSAMS, camphor, menthol, thymol, styrax, chaulmoogra oil, gurjun oil, benzoin, balsam of Peru, Canada balsam, and turpentine may be quoted.

NAPHTOL, or BETA-NAPHTOL (a phenol occurring in coal-tar, but usually prepared artificially from naphtalin), and its derivative HYDRONAPHTOL, possess stimulating, antiseptic, and anæsthetic properties, and find their chief use in chronic inflammations with infiltration of the skin, as in psoriasis, and in the parasitic affections, especially scabies.

COMPOUND TINCTURE OF COAL-TAR.

COAL-TAR in tincture form is of value in many cases where tar is indicated, especially in eczema and psoriasis and in pruritus. The "compound tincture of coal-tar," the formula for which was published by the author,[1] has been found useful, and is a substitute for similar proprietary preparations known by the names of "coal-tar saponiné," "coal-tar Le Bœuf," and "liquor carbonis detergens." With water, it being always employed diluted, it forms an emulsion. The best results are obtained by employing it in a much diluted state, five to fifteen minims to the ounce. The following is the author's formula: Coal-tar (1 part) should be digested with the tincture of quillaja (6 parts), with frequent agitation, for not less than eight days, preferably for a longer period, and finally filtered. The resultant product is a brown-black tincture, which upon the addition of water forms a cleanly yellowish emulsion, the color and certain other characters varying with the variety of coal-tar used. The strength of the tincture of quillaja should be 1 to 4 with 95 per cent. alcohol.

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[1] Amer. Jour. of the Med. Sci., May, 1894.

IODINE, IODOFORM, and the like, bromine, chrysarobin, pyrogallol, gallanol, anthrarobin, and aristol are all made use of, especially chrysarobin and pyrogallol, both valuable drugs. Iodine is useful as a stimulant and as a parasiticide. Preparations, especially ointments, containing iodine are useful for reducing glandular engorgements and indurations. An ointment composed of equal parts of iodine and mercury ointment will be found serviceable. Iodoform finds its chief use in the dressing of wounds,—as an antiseptic.

Chrysarobin, Pyrogallol.—CHRYSAROBIN is a powerful and very useful remedy. Its action upon the skin is that of a powerful stimulant, even in moderate strength tending to set up a peculiar, very active dermatitis accompanied by chemical changes, in particular by staining, the colors being varied, brownish-red, mahogany, and purplish colors prevailing. The drug, derived from goa powder, is particularly useful in removing chronic patches of inflammation, such as occur in psoriasis, eczema, syphilis, and lepra, in from one to ten per cent. strength in ointment, plaster, or collodion form, but it must always be applied discreetly, because of the inflammation of the neighboring skin that it is liable to provoke. On account of its staining properties,—staining clothing indelibly as well as discoloring the epithelial structures, its use strong, say from two to ten per cent., is restricted; but weaker—one to three grains to the ounce—it may often be employed to advantage in chronic eczematous patches and the like. The patient should always be made aware of its staining properties and of the inflammation it is liable to produce. Chrysarobin may be combined advantageously with other active remedies, as in the "compound chrysarobin ointment" (Unna), employed in psoriasis, in lepra, and in chronic inflammatory sclerosed patches generally: Chrysarobin, 5 parts; salicylic acid, 2 parts; ichthyol, 5 parts; petrolatum, 88 parts.

ANTHRAROBIN, which may be regarded as an inferior substitute for chrysarobin, is produced from alizarin by reduction. It is a yellowish-white granular powder, almost insoluble in water, but readily soluble in alcohol and weak alkaline solutions, and mixes readily with fats to form ointments.

PYROGALLOL is useful in psoriasis, but should not be used over a large surface, on account of absorption; it is also of value in carcinoma of the skin, in fifty per cent. strength, applied as a plaster, in many cases acting very favorably. Its action is slow, but is not painful. A slough forms. The drug oxidizes on exposure to the air, turning blackish and staining the skin.

ARISTOL diminishes suppuration and hastens the cicatrization of wounds and ulcers. It is said to contain a large percentage of iodine.

Chemically it is a dithymol diiodide. It is a substitute for iodoform, with which it has similar properties, and has the advantage of being comparatively odorless. In ointment form it is useful in some of the superficial and pustular forms of eczema and similar dermatoses, especially in children.

SULPHATE OF ZINC, sulpho-carbolate of zinc, acetate of zinc, alum, sulphate of copper, and sulphide of barium, are astringents and caustics occasionally employed, sulphate of zinc being the most useful.

A valuable compound, useful in many inflamed conditions of the skin, is prepared with sulphate of zinc, sulphide of potassium, and water, according to the following formula: Sulphate of zinc, ℨss.; sulphide of potassium, ℨss.; water, ℥iv. The salts are dissolved in water separately, and are then combined, the resultant being an abundant white, light precipitate. A double decomposition occurs, resulting in zinc sulphide, potassium sulphate, and precipitated sulphur. The zinc sulphide thus formed is a hydrate, and of a white, pulverulent appearance. The preparation (designated by the author[1] "zinc sulphide lotion") is used as a lotion with the sediment, and is of value, full strength or diluted, in acne, seborrhœa, superficial lupus erythematosus, localized erythematous affections, and in some forms of superficial erythematous and vesicular eczema. The proportion of the two salts used may be varied to suit the condition. Thus, for sensitive eczemas and the like, the author frequently prescribes as little as from two to five grains of each salt to the four ounces. On the other hand, in acne it may often be advantageously ordered stronger than in the formula given, or one drachm of each salt to four ounces. It is not a caustic or strong remedy.

Acids.—Of the acids, carbolic, salicylic, boric, lactic, acetic, trichloracetic, chromic, tannic, benzoic, nitric, and hydrochloric are those in common use, and of these carbolic acid, boric acid, and salicylic acid are particularly valuable. The last-named possesses the property of acting specially upon the horny layer of the epidermis.

CARBOLIC ACID.—This occupies a conspicuous place among the drugs employed in the treatment of cutaneous diseases. It is an exceedingly valuable remedy in diverse diseases, but is especially useful as an antipruritic. It benumbs the sensory nerves, acting as a local anæsthetic. In eczema it is of much value, particularly in the erythematous variety in middle-aged and elderly subjects, in many cases acting most happily. In pruritus it is of great service. It is prescribed in the form of ointment, paste, and lotion, most satisfactorily in the latter forms. As an antipruritic with water or with water and glycerin, it is employed in the strength of ten or twenty grains to the ounce. It is most efficacious in the form of compresses, but is generally used as a simple lotion. In addition to its employment in eczema and pruritus, it is serviceable in the treatment of ringworm and tinea versicolor, in pernio, in some hypertrophies, and in wart and warty formations due to varied causes. In the latter diseases, as well as in infiltrated patches of eczema, it is of course used stronger than indicated, sometimes even full strength. Applied pure it acts powerfully but superficially on the skin, producing a white film. The oftener it is reapplied on a spot, the deeper its effect penetrates. It is employed as an antiseptic and germicide in many diseases, especially in excoriated and ulcerated lesions.

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[1] Medical News, Nov. 10, 1884.

BORIC ACID is a valuable remedy in the treatment of the milder grades of congestive and exudative erythemata and in some of the more superficial inflammations generally, especially in erythematous eczema. Where the skin is naturally thin and sensitive to external impressions, and in infantile eczema and erythema-intertrigo, it is particularly serviceable. It is often useful in cases where other and stronger drugs are not tolerated. It possesses a sedative or soothing effect upon the skin, and is especially useful in the form of an aqueous lotion, to which sometimes a little glycerin may be added with advantage. It is a drug that seldom irritates the skin or aggravates the existing disease, and hence is a safe remedy. It is soluble in 25 parts of cold water, 15 parts of alcohol, and 10 parts of glycerin.

SALICYLIC ACID possesses a peculiar action upon the epidermis, gradually loosening and separating it from the corium without setting up inflammation. It is a solvent of the epidermis, but its action is altogether different from that of caustic potassa. Its effect is comparatively slow, considerable time being required to produce this result, but is perfect, as shown by the complete manner in which a circumscribed callosity may be removed by the continuous application of a ten or twenty per cent. plaster. But it is also used weak to advantage for the opposite effect,—as a regenerator of defective epithelium, being employed for this purpose, usually in ointment or paste form, in such diseases, for example, as eczema vesiculosum. The more superficially seated the disease is, the better, as a rule, is the result. Salicylic acid is soluble in 450 parts of water, in 2 parts of absolute alcohol, and (by careful heating) in 50 parts of glycerin.

Alkalies and Caustics.—Of the alkalies and caustics, potassa, potassa cum calce, ammonia, arsenic, chloride of zinc, nitrate of silver, ethylate of sodium, acetate of sodium, lime water, borate of sodium, liquid, soft, and hard soaps, and quillaja saponaria, may be referred to. They act upon the natural oils and fats of the skin, and loosen the cells of the corneous layer of the epidermis, freeing the surface of effete matter in the form of scales and crusts, thereby preparing the way for the employment of other agents. In the form of washes and baths they should be employed weak rather than strong.

Mercurials.—The mercurials in common use include mercury, the white and red precipitates, calomel, black wash, acid nitrate of mercury, ointment of nitrate of mercury, corrosive sublimate, red iodide, red sulphide, red oxide, and yellow oxide. The preparations of lead comprise litharge, the oleate, acetate, subacetate, carbonate, nitrate, and iodide.

Among the mercurials, MERCURIAL OINTMENT, CORROSIVE SUBLIMATE, CALOMEL, WHITE PRECIPITATE, and BLACK WASH are the most generally valuable. Corrosive sublimate is employed chiefly as a lotion, as a germicide, and also as a discutient. Calomel and white precipitate are used in the form of ointments in eczema and allied diseases, and in syphilitic manifestations, although for this purpose they are inferior to mercurial ointment. The latter may sometimes be used, weakened, especially with oxide of zinc ointment, with benefit in various lesions other than those due to syphilis. Owing to the readiness with which mercury is absorbed by the skin through inunction, this ointment should not be used over large areas of surface for a long-continued period without due precaution.

Two or more mercurials are sometimes combined with advantage, as in the following, generally known in London as "Startin's nitric oxide of mercury ointment," useful especially in subacute eczema: Red (nitric) oxide of mercury, gr. vi; bisulphate of mercury, gr. iv; wax cerate, ℥i. An ointment much used in England, known as "unguentum metallorum," is composed of equal parts of ointment of acetate of lead, ointment of nitrate of mercury, and ointment of oxide of zinc. White precipitate ointment may be substituted for the ointment of nitrate of mercury.

Some of the mercurials may often be added with advantage to the sulphur ointments, as in the following formula, long known in France and Germany, and in the latter country called "the shepherd's salve:" Red sulphuret of mercury, 1 part; sublimed sulphur, 24 parts; lard, 75 parts. It is useful in various pustular affections, especially in those involving hairy regions.

Such drugs and preparations (some of them analgesic) as ALCOHOL, ETHER, chloroform, collodion, liquor gutta-perchæ, ethyl chloride, opium, morphine, COCAINE, cannabis indica, belladonna, aconite, atropine, ergot, cyanide of potassium, witch-hazel, solution of peroxide of hydrogen, permanganate of potassium, and chloral, are employed for various purposes.

Cantharides, mustard, croton oil, tartar emetic, and arbor vitæ are occasionally called into requisition.

COLLODION and LIQUOR GUTTA-PERCHÆ ("traumaticin") both serve as excellent vehicles for applying many remedies to the non-hairy regions, as, for example, chrysarobin. The oils of tar may be advantageously applied with collodion, a half-drachm or more to the ounce. After drying, an additional coating of pure collodion over the medicament may be applied, in order to protect the clothing. The compound tincture of benzoin may also be used as a vehicle for applying various medicaments to the skin, such as corrosive sublimate in tinea circinata, as suggested by R. W. Taylor.

The mode of employment of some of the drugs and remedies enumerated, especially the forms in which they are commonly used, as well as the special preparations, may be conveniently considered under the following heads.

MODES OF TREATMENT.

Water, Baths.—Water, used for the purpose of cleansing the skin and removing effete matter, as scales and crusts, with the view of treating the skin itself, or in the form of more or less prolonged baths, simple or medicated, is a most useful therapeutic agent. Its employment, however, should be directed with judgment, inasmuch as in certain morbid conditions, as many cases of eczema, it is liable to produce mischief rather than benefit. Where plain water is used, soft or rain water is preferable. The warm bath is especially serviceable in certain inflammatory diseases, as psoriasis, and in hypertrophies of the epidermis and the corium, for example, ichthyosis. The beneficial effect of the continuous application of warm baths of simple water in chronic psoriasis is exemplified strikingly at Leukerbad, Switzerland, where patients (both sexes in common) remain submerged for hours or for half the day, walking, sitting, talking, and reading in a large pool. The continuous warm bath, so constructed with mattress and pillows that the patient is enabled to remain comfortably in the water for days or weeks at a time, may also be referred to as being useful in the treatment of extensive chronic inflammations of the skin, such as pemphigus, psoriasis, and burns. Plain water, cold or hot, is also used to advantage in the form of douches, with or without friction, as in acne. The vapor or steam bath is particularly useful where the skin needs stimulation, as in chronic acne, comedo, and keratosis pilaris. The stimulating effect locally of a hot bath at from 100° to 110° F. is generally obtained in from five to ten minutes: baths prolonged much beyond this duration are usually followed by general depression.

Hot water (for most cases as hot as can be borne) often acts happily in relieving local congestion, inflammation, and nerve irritation. Thus, in some cases of localized eczema, especially circumscribed patches, and in pruritus, compresses or cloths wrung out of hot water and applied to the part will generally afford much relief during a paroxysm of itching.

THE WET PACK.

The wet pack, with tepid or cold water, consists of a sheet or pieces of sheeting wrung out of water, with which the patient is wrapped closely and then wrapped in and covered with blankets for half an hour or longer, diaphoresis being thereby induced, after which the skin is rubbed dry and anointed. This mode of bathing is useful in extensive or universal inflammations, and especially in psoriasis. It tends to allay heat and irritation, and to soothe the nerves, especially when the cold pack is used. The beneficial effects upon the general health of the cold water pack have been pointed out by numerous observers. The experiments of Blagoveshchenski[1] show that in healthy persons cold packs produce increased nitrogenous metabolism and assimilation of nitrogens, with increased loss by the skin, and that they diminish the quantity of nitrogens retained in the body. They slow the pulse and respiration and raise the arterial pressure; lower the temperature; augment the appetite; cause the person to sleep well; and give increased strength, with a general sense of feeling in good health. The effect of the Turkish bath on the system has been considered in the chapter devoted to the physiology of the skin.

Under the influence of tepid sweet water baths (temp. 85° to 95° F.) of from one-half to one hour's duration, the assimilation of fats is augmented in healthy persons, as shown by the gain in weight. But in the case of saline baths the opposite is noted, the assimilation of fats being invariably lessened, with a diminution in the secretion of urine.[2]

Contrary to the generally accepted opinion, Goldberg[3] found that the influence of warm baths and sweating upon the elimination of drugs was to diminish the excretion of the same by the urine.

SULPHUR AND THERMAL WATER BATHS.

The SULPHUR OF SULPHURETTED WATERS, as, for example, those of Richfield, Sharon, and Avon, in New York, as well as many others in the United States, are useful in varied diseases of the skin. The manner in which they act upon disease is not always clear, but that cures often take place through bathing cannot be questioned. At the same time, the author is of opinion that their value as curative agents is generally over- rather than under-estimated, and that their indiscriminate employment often results in no benefit to the patient.

Among the SULPHUR SPRINGS richest in sulphur compounds are Herculesbad, in Hungary, and Aachen (Aix-la-Chapelle), in Germany. The former contains about 105 grains to the quart of water, and the latter 60 grains. As a rule, sulphur wells are poor in solid constituents, and it is probable that, in most cases at least, no specific action is to be derived from their use. The sulphurous baths of Aachen, renowned for the treatment of syphilis, doubtless owe their efficacy as much to the simultaneous free use of mercury and the iodides as to the strong sulphur compounds in the water. The same remark applies to the Hot Springs of Arkansas (although these springs are not sulphurous), where also mercury and the iodides are freely used, and are remarkably well tolerated, in the treatment of various diseases, but especially of syphilis.

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[1] Lond. Practitioner, Nov. 1889.

[2] See the experiments of Zavadsky and Slütchevsky (Lond. Med. Rec., Nov. 20, 1890); also Kravkoff, *ibid.*, Oct. 20, 1890.

[3] Universal Annual of the Medical Sciences, edited by Sajous, vol. v., Bd. lii., 1890.

There are many other well-known HOT SPRINGS in the United States, such as, for example, those of Virginia, North Carolina, and New Mexico (Las Vegas), as well as others in Colorado, California, and other States. Many springs of this kind are for the most part simple THERMAL WATERS, depending for their virtues upon the high temperature and other peculiarities rather than upon specific salts or gases which they may contain, often in small amount. The waters of the Hot Springs of Arkansas resemble in their analysis those of Gastein, Austria, and Pfäffers, Switzerland. The Paso Robles Hot Springs, of California, are somewhat like those of Aachen, while the Idaho Hot Springs, of Colorado (near Denver), are alkaline and similar to Carlsbad waters.

The action upon the skin of some baths of this kind (thermal waters), as the Warm Springs of Virginia and Schlangenbad (the Serpent Bath) and Wildbad (near Stuttgart), Germany, is peculiar. A velvety smoothness is imparted to the skin, as though it had been anointed. It is probably due to the presence of certain silicates in the water.

MEDICATED BATHS.

The ordinary bath contains from 25 to 30 gallons of water. The temperature for prolonged baths should be from 90° to 100° F., according to the disease, the patient, and other circumstances. Emollient and soothing baths are made with starch (1 to 3 lbs. to the bath); bran (2 to 5 lbs.); linseed (1 lb.); gelatin (1 to 3 lbs.); and size (1 to 3 lbs.). The substances should be acted upon by boiling water in a small vessel, strained through a coarse cloth, and then added to the bath.

ALKALINE BATHS are prepared with carbonate of sodium (2 to 10 oz.) or potassium (2 to 5 oz.), preferably the latter; borax (like strength) is also acceptable; and a good bath is made by dissolving and using ½ to 1 lb. of soft soap, which proves serviceable in the papular urticaria of children, in some eczemas (with chronic thickening), and in psoriasis. Bran may be sometimes added with advantage to the alkaline baths.

The SULPHUR BATH is most conveniently made with sulphide of potassium (ʒii to ʒiv to the bath), to which may be added bran or gelatin, prepared as above stated. Startin's compound sulphur bath is prepared with precipitated sulphur, ʒii; hyposulphite of sodium, ʒi; dilute sulphuric acid, ʒss.; mixed in a pint of water and then added to the bath. Leichtenstern[1] gives a formula calling for sulphide of calcium (ʒiii to ℥iv), with the addition of crude hydrochloric acid (℥iii), to thirty gallons of water. The inhalation of the hydrosulphuric acid should be prevented by spreading a cloth across the bath.

The TAR BATH is given by tarring the skin and allowing the patient to remain in a warm bath for several hours, a procedure which is usually employed only in desperate cases of psoriasis.

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[1] Ziemssen's Handbook of General Therapeutics, vol. iv. p. 443. London, 1885.

SALT, OR BRINE, BATHS.

The effect of the salt water, or brine, bath upon the skin may be regarded as stimulating, although it varies locally, as it does generally with the vigor of the individual, the temperature of the water, and the duration of the bath. The strength of the average sea water is somewhat over two per cent. The effect of the salt, or brine, bath upon some diseases of the skin is beneficial. The salt obtained from the natural brine wells of the interior is well adapted for preparing artificial salt-water baths, being purer, cleaner, and more readily soluble than sea salt. In a five per cent. solution, the most generally useful, it cleanses the skin more thoroughly than soap, and removes odors and exuviæ, thus acting as a deodorizing as well as a cleansing agent. This strength also leaves the skin soft and supple. Piffard has carefully studied the effect of the salt-water bath upon the skin in health and in disease, and has presented his conclusions to the American Dermatological Association.[1]

These baths (five per cent. strength, or about 10 lbs. of salt to 25 gallons of water) are regarded as of service in several cutaneous diseases, especially in some cases of subacute eczema, in psoriasis, in furunculosis, in urticaria, and in the irritable rashes of hot weather; also in the pustular and ulcerative syphilodermata, and in the scrofulodermata. Even in acute moist eczema, where, as is well known, the plain fresh-water bath, with or without soap, usually aggravates the disease, Piffard finds a weak brine bath (½ lb. to 1 lb. of salt to 25 gallons of water) of service, the patient usually observing that the skin feels better than it did before the bath. For most cases the water should be as hot as can be comfortably borne, the immersion lasting about fifteen minutes.

Common salt or brine wells, with accommodations for bathing, exist at Warsaw, New York, at Mt. Clemens, Michigan, and in Europe at Kreuznach and Nauheim.

Soaps.—The two varieties of soap principally made use of are the soda, or hard, and the potash, or soft. Both are employed extensively as therapeutic agents, and are brought into frequent requisition for various purposes. The hard soaps find their office mainly in cleansing the skin of ordinary extraneous matter, and as a basis for some of the medicated soaps.

SOFT SOAP, termed also SAPO MOLLIS and SAPO VIRIDIS, is a soft, yellowish, brownish, or greenish soap, containing an excess (usually about 4 per cent.) of caustic potash. The fatty substance from which it is made may be an animal fat or a vegetable oil of one kind or another, differences which, together with the manufacture, account for its variable character as to caustic property, consistence, color, and odor. It is a useful agent, employed alone with water, with alcohol in the form of a tincture, as in the "spiritus saponatus kalinus" (two parts of soap and one part of alcohol), or in combination with certain oils, as the tarry oils and other substances. It is an effective detersive agent, and usually proves sufficient to free the skin of scales, crusts, and other foreign matter. As its effect upon the skin is mildly caustic, its employment should be restricted. When applied for any length of time or repeatedly, this property should be counteracted by the subsequent application of some bland oil or fat, to prevent roughness and chapping of the epidermis. Through ignorance of the anatomy and physiology of the epidermis, soaps are very commonly misused by being employed to excess. In cases where the epidermis is naturally weak or is slightly diseased, the use of soap may often be restricted or withheld to advantage.

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[1] Salt in Dermal Hygiene and Therapeutics, Jour. of Cut. and Gen.-Urin. Dis., vol. v. p. 421, 1887.

MEDICATED SOAPS.

Concerning the so-called TOILET SOAPS, for the purpose of cleansing healthy skin, care should be exercised in selecting one that is superfatted, neutral, or but slightly alkaline in reaction, according to the demands of the skin of the individual. Soaps of this kind not infrequently contain an excess of alkali, and consequently act harshly on the skin. This remark applies particularly to many of the glycerin and transparent soaps, most of which will be found when tested to contain free alkali, sometimes in considerable quantity. To remedy this defect both toilet and medicated soaps have been produced not only neutral in reaction but containing an excess of fat, designated "superfatty soaps." Medicated soaps are manufactured extensively and perfectly, and many new and useful formulæ have been published. Their employment as an adjuvant is of considerable value in the treatment of certain diseases. Unna,[1] Eichhoff,[2] and Buzzi[3] have introduced a large variety of such soaps, hard, soft, and liquid, with definite formulæ. A basis soap is prepared, according to Unna and Mielck's formula, by the addition of two or (in summer) three parts of freshly prepared soda and one part of potash lye to pure beef tallow, to which (to prevent the drying effect on the skin common even to neutral soaps) 4 per cent. of olive oil is added over and above that required for saponification. This simple superfatty soap perfumed is in itself useful for ordinary toilet purposes, especially for those persons whose skin is naturally delicate, dry, and chapped, or irritable. Potash is used because it acts more effectively than soda on the horny layer of the epidermis, and the mixture of the two alkalies gives a better consistence to the soap. The mass in reaction is absolutely neutral, is of a yellowish-white color and of the consistence of wax, and is stable. These soaps are applied in different ways, as simply washing the skin, rubbing the lather in with woollen cloths, or allowing the lather to dry on the skin.

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[1] Volkmann's Sammlung Klin. Vortr., No. 252.

[2] Ibid., Neue Folge, No. 4, 1890.

[3] Correspondenz-Blatt f. Schweizer Aerzte, No. 13, 1891. Unna's soaps, elaborated in conjunction with Dr. Mielck, chemist and apothecary, and manufactured by Douglas, of Eimsbüttel, near Hamburg, comprise, among others, zinc soap, which has a drying action on the skin and is useful in the several disorders of secretion; salicylic acid soap, of use in subacute and chronic eczema, and in acne; ichthyol soap, employed in rosacea and in squamous eczema; and marble soap, containing 20 per cent. of marble dust, used in the keratoses and in acne for its mechanical action. Eichhoff's formulæ are manufactured by F. Mühlens, in Cologne, and contain as superfat 2 per cent. lanolin and 3 per cent. olive oil, the soap mass being made of 3 parts of pure tallow and 1 part of olive oil. A list, comprising many of the active remedies in use, is published.

In cases where the skin is oily and greasy, the ordinary hard, so-called neutral soaps, medicated with various substances, such as sulphur, birch tar, boric acid, ichthyol, naphtol and sulphur, salicylic acid and glycerin, and corrosive sublimate, are useful adjuvants to other treatment.[1] A superfatted potash soap has also been prepared by Unna and Mielck, which occupies a position midway between ointments and soaps, and is designated "sapo unguinosus." Of medicated soaps of this kind may be mentioned "sapo cinereus unguinosus," useful for the introduction of mercury into the system, and "sapo unguinosus ichthyolatus."

Another advance in soap therapy, in the form of fluid soaps, introduced by Buzzi,[2] may be referred to. A neutral soap basis is first made, which is either superfatted with lanolin or rendered alkaline by carbonate of potassium (1 per cent. or more). Of these soaps some are neutral, others alkaline, and some superfatty. For certain diseases there are some advantages in fluid over hard soaps.

H. Hebra[3] also speaks well of the "glycerinum saponatum" preparations.[4] The soap-basis is an absolutely neutral cocoanut oil soda soap, in cake form, containing a large percentage (80 per cent. and 92 per cent.) of glycerin, with which the various drugs are incorporated.[5] The creosote-salicylic-acid preparation (composed of 90 per cent. of an 80 per cent. "glycerinum saponatum" and 5 per cent. each of salicylic acid and creosote) is highly extolled as a powerful antibacillary remedy, especially useful in lepra.

Dusting Powders.—These are employed in the management of certain of the hyperæmic and inflammatory disorders, such as erythema, intertrigo, and eczema, and in some disorders of the sweat glands. They are composed of one substance, or of several substances mixed in varying proportions. Wheat-starch, corn-starch, arrow-root, rice flour, oxide of zinc, carbonate of zinc, stearate of zinc, carbonate of magnesium, oleate of zinc, bismuth subnitrate, kaolin, boric acid, alum, salicylic acid, chalk, French chalk, talc, and the silicious earths, reduced to impalpable powders, are all used for this purpose. They should be prepared with care and be perfectly smooth and free from grit. The blander substances serve to protect the surface from the influence of the air, from irritation and rubbing, and to absorb exuded fluids. The absorptive powers of the several substances used for dusting powders have been tested by Gruendler,[1] who finds that magnesium carbonate stands first on the list, taking up 5½ times its weight of water. Infusorial earths and silicious substances of different kinds ("*kieselguhr*") take up 3½ times; kaolin, 1⅓; zinc oxide, 1⅕; talc, ⅗; creta, ⅖; amylum, 1; and lycopodium, ½. As a simple dusting powder for the purpose of absorbing discharges, magnesium carbonate is unexcelled. Stearate of zinc is also useful, either alone or as a basis for other substances. It is a fine, white, soft powder, is light in weight, and is tenaciously adherent to the surface. It is non-hygroscopic, and does not tend to ball.

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[1] J. S. Stiefel & Co., of Offenbach-on-the Main, Germany, manufacture such soaps.

[2] Monatsh. f. p. Derm., Bd. x., 1890, p 459. Manufactured by Veysser, of Hanover

[3] Die Moderne Behandlung der Hautkrankheiten, Wien, 1890.

[4] Made by Sarg, the well-known soap-manufacturer of Vienna.

[5] The list of soaps manufactured may be found in Hebra's work above referred to.

Lotions.—Lotions constitute a desirable and cleanly means of applying a large number of remedies. In many instances they are better adapted for the relief of disease than ointments; this is particularly the case when the affection occupies a large amount of surface, as, for example, often occurs in urticaria and pruritus. In practice it will be found that the skin of some persons tolerates lotions in general better than ointments. They may be classified for convenience into the soothing, the stimulating, and the astringent.

SOOTHING LOTIONS.

Soothing lotions are usually aqueous or oleaginous preparations containing substances which allay hyperæmia, inflammation, and nerve irritation. Those in common use are lime water, lime water and oil, lead water, glycerin and water in various proportions, the glyceroles, as of lead, zinc, and bismuth, weak solutions of tar and carbolic acid, and boric acid. The last-named in particular is of great value as a lotion in many conditions. Washes containing in suspension bland powders, such as oxide of zinc, calamine, and chalk, are particularly soothing in some of the acute superficial inflammations. They are for the most part made up with several ingredients with the view of modifying or arresting inflammation in its early stage. The following formula, much used by the author, may be given: powdered prepared calamine, ʒi; oxide of zinc, ʒi; glycerin, ʒss.; lime water, ℥vi. Lotions of this kind find their use chiefly in the simple erythemata and in acute and subacute erythematous and vesicular eczema.

STIMULATING LOTIONS.

Stimulating lotions contain alcohol, ether, certain volatile oils, aqua ammoniæ, acetic acid, cantharides, carbolic acid, corrosive sublimate, black wash, tar, alkalies, camphor, menthol, thymol, benzoic acid, chloral, ichthyol, sulphur, resorcin, sulphide of potassium, and the like; several of these substances are not infrequently variously combined with advantage. They prove of value in affections of the scalp, as in seborrhœa, eczema, and psoriasis, where oils and ointments may be contra-indicated on account of the hair. They are also of service in diseases of the sebaceous and sweat glands, and in chronic inflammations, as in acne, acne rosacea, lupus erythematosus, and eczema.

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[1] Ueber Pasten: Monatsh. f. prak. Derm., No. 20, 1888.

It may be stated here that many of the so-called stimulating lotions prove sedative and soothing when employed in a weak state, diluted with water. Thus, black wash, compound zinc sulphide lotion, compound tincture of coal-tar, all much diluted, often prove soothing. A useful sedative lotion recommended by Hutchinson is composed of: Solution of subacetate of lead, ♏x; compound tincture of coal-tar, ʒi; water, Oi. This may be employed in chronic erythematous and squamous eczema and similar diseases.

ASTRINGENT LOTIONS are made with alcohol, tannic acid, alum, iron, acetic acid, vinegar, sulphate of zinc, acetate of zinc, ergot, hamamelis, and like substances, their principal employment being in hemorrhagic conditions and in disorders of secretion.

Oils.—Some of the natural oils are bland, while others are stimulating. To the first class belong olive oil, oil of sweet almond, linseed oil, walnut oil, palm oil, cocoanut oil, lard oil, glycerin, castor oil, cod-liver oil, and some of the petroleum oils. Bland oils are serviceable for softening and detaching scales and crusts, and for anointing the surface in a variety of conditions. They also enter largely into the composition of ointments and lotions. Examples of stimulating oils are found in the derivative oils from tar, as oil of cade and oil of birch, and in oils derived from certain woods, nuts, and balsams, as the oil of cashew-nut, and gurjun oil or balsam, known also as "wood oil."

Ointments.—Ointments constitute the usual, the readiest, and in many cases the most valuable means of applying remedies to the skin. They are made with various fats, commonly with prepared lard, lanolin, adeps lanæ, or one of the bland petroleum ointments, and usually contain one or more active substances upon which their chief virtue depends.

Concerning the penetration of different ointment bases, Aubert[1] experimented with atropine, causing the subjects to sweat through exercise, and then examining the fluid. With simple inunction, oils and lard penetrated best, but when friction was used lanolin did best, probably owing to erosions of the epidermis or to the pulling out of hairs, absorption being thus favored. According to Luff's[2] experiments on the absorption of medicaments from ointments, the petroleum ointments permit of the most rapid absorption, lanolin being the slowest.

Like the lotions and the oils, they may be divided into those which are bland and have a soothing, sedative effect, and those which stimulate.

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[1] Jour. Cut. and Gen.-Urin. Dis., Dec. 1892.

[2] Monatsh. f. prak. Derm., Bd. xi., No. 2.

While in some cases ointments may be rubbed firmly or vigorously into the skin with benefit, in most instances they accomplish more good if they are rubbed in gently, smeared on lightly, or applied spread thinly on cloths and bound on.

SOOTHING OINTMENTS.

In this class may be placed simple ointments and cerates, "cold cream," lanolin ointments, glycerin ointments, ointments of cacao butter and spermaceti, cucumber ointment, petroleum ointments, diachylon and oxide of zinc ointments, and many other preparations possessing similar properties. They are for the most part bland in their nature, and are employed chiefly in inflammatory conditions, with the view of protecting the surface and of allaying irritation. Diachylon ointment, prepared from diachylon plaster or from litharge with olive oil, is a useful remedy in the treatment of eczema. Oxide of zinc, carbonate of zinc, oleate of zinc, and oleate of bismuth ointments are likewise valuable in ointment form, finding their principal use in eczema. These ointments are frequently made to serve as vehicles for the application of other remedies, such as tar, salicylic acid, resorcin, and the mercurials. They are rubbed gently into the skin or are smeared on lightly, or, still better, in many cases, where practicable, are spread on cloths or strips of muslin and bound on to the affected part.

H. Hebra recommends a soothing boric acid ointment that may be endorsed as an elegant preparation. The formula is: Boric acid, white wax, and paraffin, of each, 10 parts; oil of sweet almond, 60 parts. The product is a very good oily ointment, somewhat softer than cold cream ointment (U.S.P.). It approaches nearer to the official cold cream ointment, but contains no glycerin, which for many cases is an advantage. An elegant, soft, oily, clean, odorless ointment, which may be designated "boroglycerin cream ointment," consists of: Boric acid, 1 part; glycerin, 24 parts; lanolin (anhydrous), 5 parts; vaseline, 70 parts. The boroglycerin solution is to be added to the lanolin and vaseline. Another good boric acid ointment containing glycerin is composed of: Boroglycerite, ʒii; white wax and cetaceum, of each, ʒi; vaseline, ʒvi.

A distinctly soothing ointment, useful in superficial inflammations, especially erythematous and squamous eczema, recommended highly by McCall Anderson, is composed of: Oxide of bismuth, 3i; oleic acid, ℥i; white wax, ʒiii; vaseline, ʒix; oil of rose, ♏v. This, however, is not a true oleate ointment. The oleates of zinc and bismuth are sometimes made use of, but they do not possess any special advantages, and their rancid odor is objectionable.

A lanolin-lard-rose-water soft creamy ointment is made of: Lanolin, 10 parts; lard, 20 parts; rose water, 30 parts. It possesses the advantage of keeping well. A very soft, creamy, cooling ointment, with lanolin as a base, is made as follows: Lanolin, 65 parts; liquid paraffin, 30 parts; white wax, 5 parts. Melt together, and add and rub in water 30 parts, the water to be warmed before adding, and the heat to be continued for a few minutes.

A thick EMULSION, useful for various purposes, may be made by mixing equal parts of lard and lime water, with which carbolic acid and other active remedies may be incorporated. It must be shaken before being applied, as it is not a permanent emulsion.

STIMULATING OINTMENTS.

These are the most efficacious and generally useful remedies we possess. They are made with a great variety of substances, which are employed alone or in combination. Tar and its oils and derivatives, especially oil of cade, oil of birch (oleum rusci), carbolic acid, and creosote, may first be mentioned, all particularly valuable in eczema and psoriasis. The preparations of mercury, including red oxide, yellow oxide, nitrate, red iodide, red sulphide, mild chloride, corrosive chloride, and ammoniated mercury, and mercury itself, are all employed and highly prized for their virtues in numerous and different diseases. Sulphur, resorcin, ichthyol, thiol, naphtol, and salicylic acid may be referred to as among the more important remedies of this class. Here may be mentioned goa powder and its derivative chrysarobin (formerly known as chrysophanic acid), and also pyrogallol. Chrysarobin is of great value, and employed weak (from one to five grains to the ounce) is useful in many diseases. Iodine, iodoform, iodol, and other preparations containing iodine may be referred to, as well as camphor and chloral, singly or in combination, thymol, and menthol.

Special Preparations.—Some new methods of applying local remedies have been introduced, especially through the labors of Unna, Lassar, Pick, and others. These may be designated special preparations, requiring, in most instances, for their manufacture the aid of the apothecary and the manufacturer. They constitute useful additions to the dermatological armamentarium. They may be described under the headings of plasters, salve-muslins, plaster-muslins, glyco-gelatins, tragacanth jellies and emulsions, pastes, salve-pencils, and paste-pencils.

PLASTERS.

Plasters, made with various adhesive substances, especially wax, resin, lead plaster, and the like, two or more usually being combined, are employed chiefly for the purpose of bringing active remedies, particularly mercurials and caustics, in close contact with the skin. I. Neumann gives the following formula for a good adhesive plaster the base of which is lead plaster. Some drugs, however, on account of their non-compatibility with lead plaster, cannot be employed with it. It is composed of oil of turpentine, 1 part; yellow wax, 1½ parts; lead plaster, 6 parts. A mercurial plaster much used in Germany consists of: Mercury, ʒiv; turpentine, ʒii; yellow wax, ʒiii; lead plaster, ℥iss. This may be spread on a cloth and applied. It is useful in syphilitic scleroses, lupus vulgaris, and sometimes in chronic lupus erythematosus and localized patches of chronic acne rosacea.

A firm and remarkably adhesive plaster, useful for incorporating various remedies, particularly such caustics as pyrogallol and resorcin, as employed in lupus vulgaris and epithelial cancer, can be recommended by the author, who devised the formula. It consists of: Burgundy pitch, ʒx; resin and yellow wax, each, ʒiv; oil of turpentine, ʒii; Canada balsam, ʒss.

PLASTER-MUSLINS.

These have as a basis gutta-percha and oleate of alum, with which drugs in varying strengths are incorporated. The mass is spread in a thin layer on muslin. The gutta-percha forms an impermeable basis, while the oleate of alum constitutes the adhesive element, and possesses, moreover, the desirable property of being unirritating to the skin. A great variety of drugs may be incorporated with the plaster mass. Among the many preparations the following may be mentioned: carbolic acid, boric acid, arsenous acid, salicylic acid (in several strengths), chrysarobin, pyrogallol, iodoform, mercury, mercury and carbolic acid, mercury and oxide of zinc, oxide of zinc, tar, litharge, white precipitate, ichthyol, ichthyol and sublimate, adhesive plaster (with salicylic acid), resorcin, and creosote and salicylic acid. They are useful in a great many localized affections, especially in eczema, psoriasis, lupus, acne, acne rosacea, and various infiltrated patches. They are applied after the manner of other plasters. They possess the advantages of acting quickly and strongly, of being adhesive, and of remaining in constant contact with the diseased part. They are, moreover, unirritating and cleanly, are readily applied, and protect the skin from external irritation. To Unna especially is due the credit of introducing and perfecting these preparations.[1]

SALVE-MUSLINS.

These consist of an ointment-mass spread accurately and evenly, by machinery, on undressed muslin, or mull, and are intended to take the place of strips of muslin spread with ointment by means of the knife. They are neater, cleaner, more comfortable, more elegant, and more readily adaptable to the surface than salves as ordinarily spread.

The salve-mass consists, as a basis, of benzoinated mutton tallow and wax (the amount of the latter varying with the several preparations), with which the various drugs are incorporated. The muslin sheets are dipped into the melted mass, dried, and rolled flat and smooth on both sides. Another series is prepared, where only one side is so treated. They are soft and pliable, and, owing to the warmth of the body, adapt themselves to the skin. Being uniformly spread, they are more efficacious than the ordinary salves spread on muslin. They prove useful in many diseases, especially in eczema and other localized inflammatory affections. Owing to their softness and suppleness, they adapt themselves to the various depressions and to the joints of the body. Diachylon ointment and oxide of zinc ointment are both more elegantly and accurately applied in this manner. The mercurial salves, including white and red precipitate and mercurial ointment, are advantageously incorporated with the zinc oxide tallow base, while the tarry and balsamic products mix well with the lead plaster base. To avoid rancidity, the mass may be made with wax, petrolatum, and a little lanolin, or with wax and lanolin.

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[1] These, as well as the salve-muslins, are manufactured by P. Beiersdorf & Co., apothecaries, Hamburg, and may be obtained in most of the large cities of the United States and other countries.

The following medicaments are those in most common use: litharge plaster, litharge and ichthyol, litharge and carbolic acid, litharge and tar, oxide of zinc, oxide of zinc and salicylic acid, oxide of zinc and ichthyol, oxide of zinc and sulphur, and resorcin.

PASTES.

These differ from ointments in being of stiffer consistence and more adhesive, and in leaving on the skin an adherent coating. They should be so prepared, and should contain such ingredients as a basis, that they may be easily spread over the skin in a thin layer and will dry quickly. Erasmus Wilson many years ago recognized the good to be gained by the use of stiff ointments of oxide of zinc, which were of the character of soft pastes. Lassar,[1] however, was the first to call special attention to the value of this method of treatment, since which time the subject has been elaborated by Unna,[2] Gruendler,[3] and others. Many substances have been suggested as the basis for these preparations, chief among which may be mentioned starch, oxide of zinc, gum arabic, dextrin, oxide of lead (litharge), and kaolin, made with various fluid or semi-fluid ingredients, such as glycerin, linseed oil, and petrolatum, together with the medicament. The formulæ for some of these may be stated.

STARCH.—The formula originally suggested by Lassar, consisting of starch and zinc oxide each 25 parts, petrolatum 50 parts, is a valuable one, much employed alone and also as a basis in erythematous and eczematous conditions. One slight objection, according to the author's experience with this paste, is that it adheres to the cloths covering the skin and to the underclothing as well as to the skin, and after drying it tends to drop off in particles, lumps, and rolls, and thus to be a source of annoyance to the patient. The following softer paste the author has found adheres to the skin rather than to the clothing, and is preferred by some patients as being a more cleanly preparation: Boric acid, ℈ii; starch, ʒii; zinc oxide, ʒii; vaseline, ℥i. Boric acid possesses in a notable degree the property of stiffening pastes and ointments.

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[1] Monatsh. f. prakt. Derm., No. 4, 1883.

[2] Monatsh. f. prakt. Derm., 1884, p. 88.

[3] Monatsh. f. prakt. Derm, 1888, p. 1029.

Unna gives a formula of starch 3 parts, glycerin 2 parts, and water 15 parts, to be boiled down to 15 parts. This constitutes the basis, to which may be added half or more, according to the consistence desired, of the powdered medicament, though if more than half the volume of powder is required the quantity of glycerin should be increased. Another formula consists of zinc oxide 50 parts, starch 15 parts, salicylic acid 2 parts, glycerin 15 parts, water 75 parts; to be mixed and boiled down to 140 parts. Another formula, suggested by Ihle, is composed of lanolin, petrolatum, zinc oxide, and starch, of each two drachms.

The following formula makes a very stiff paste, remarkable for its adherent and drying properties: Lanolin, 65 parts; paraffin, 30 parts; white wax, 5 parts; mix, and add water 30 parts. Equal parts of zinc oxide and petrolatum, the author finds, make a clean paste. Zinc oxide and starch, of each ʒii, and cold cream ointment, ʒiv, also make a desirable stiff paste.

Gum.—The basis here consists of 1 part of mucilage of gum arabic, 1 part of glycerin, and 2 parts of a powder, such as zinc oxide.

Dextrin.—The basis consists of equal parts of dextrin, glycerin, and water, to which a powder, as zinc oxide, may be added as required.

Lead.—Lead pastes are sometimes employed, which may be made according to the following formula published by Unna: Powdered litharge, 50 parts; vinegar, 80 parts; cook to the consistence of a paste, and add olive oil, linseed oil, or glycerin, 10 parts. Additional vinegar may be used from time to time should it become too dry.

Kaolin.—Kaolin, mixed with two parts of olive or linseed oil, has been recommended by Unna and others for a simple paste, but this earthy substance varies so much in its composition that from formulæ the results as to consistence cannot be depended upon. The product, moreover, is oily and doughy, and hence not satisfactory. Unna recommends for eczema a paste prepared with kaolin 3 parts, oxide of zinc 2 parts, linseed oil 3 parts, lead water 2 parts. The kaolin and oil must be mixed before adding the other drugs.

The drugs best adapted to the several pastes mentioned may be referred to: oxide of zinc with the kaolin, lead, starch, dextrin, and gum pastes; lead with the lead or dextrin paste; sulphur and tar with the starch, dextrin, and gum pastes; ichthyol with all except the gum; salicylic acid with all; carbolic acid, camphor, and chloral with all; chrysarobin and pyrogallol best with the gum and kaolin; iodine and iodoform with the lead, kaolin, and gum; and white and red precipitate, calomel, and sublimate with all. Animal, vegetable, and mineral fats and oils, as well as soaps, in small quantity, may be incorporated with the pastes without injuring them.

GLYCO-GELATINS.

The basis of these preparations consists of glycerin and gelatin in certain proportions, together with zinc oxide or other similar substance. The zinc oxide is the best. Unna[1] gives the following formulæ for two forms, a hard and a soft product. The hard is composed of zinc oxide 10 parts, gelatin 30 parts, glycerin 39 parts, water 30 parts; the soft, of zinc oxide 15 parts, gelatin 15 parts, glycerin 25 parts, water 45 parts. Chrysarobin, white precipitate, and iodide of lead are miscible with either, and are used in from 5 to 10 per cent. strength. Iodoform and sulphur, in from 15 to 30 per cent. strength, are also miscible with either, while salicylic acid, resorcin, naphtol, potassium sulphide, creosote, and carbolic acid exercise an inhibitory influence on the setting of the gelatin, and should be used with the hard variety only up to 10 per cent. Tars, balsams, fats, and ichthyol should be incorporated with the hard form, and not beyond 33 per cent. The solid glyco-gelatin is melted in a hot-water bath and applied as a coating to the diseased area. Immediately afterwards a strip of muslin or a layer of absorbent cotton may be applied, which serves as an additional protective covering. In itching patches this close covering of itself prevents scratching.

Glyco-gelatins are of value chiefly in the acute and chronic inflammatory diseases, as in erythema, dry localized eczema, inflammatory acne, and localized pruritus. Their action is superficial, but they possess positive advantages in being protective, in preventing scratching, and in excluding air, which latter in some cases is a point of importance in the treatment. They are cleanly and comfortable; and the base may be employed as a fixing agent or cement for the salve and plaster muslins where it is desirable to make of these an impermeable dressing. The drugs in common use are tar, resorcin, sulphur, ichthyol, and salicylic acid.

TRAGACANTH JELLY AND EMULSION.

Instead of gelatin, tragacanth may be employed, as suggested by F. J. Pick, of Prague, which possesses an advantage in that the dressing may be readily removed with water. A TRAGACANTH-GLYCERIN JELLY (Pick's formula, called by him "linimentum exsiccans") is made as follows: Tragacanth, 5 parts; glycerin, 2 parts; boiling water, 93 parts. The tragacanth is to be triturated until a smooth mass results, and the glycerin then added. To the whole the author adds 2 per cent. of boric acid as a preservative. This formula is sufficiently soft to be readily smeared over the surface, upon which it quickly dries, and at the same time is distinctly cooling. Fifteen or twenty grains of oxide of zinc to the ounce improves the consistence for most cases. Various active medicaments, as salicylic acid, resorcin, carbolic acid, and the like, may be incorporated with the mass. It is a cooling and acceptable preparation, especially for the face, in erythematous eczema and similar affections. Bassorin, a derivative from gum tragacanth, may be likewise used for the same purpose, as suggested by G. T. Elliott, of New York.

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[1] Monatsh. f. prakt. Derm., p. 317, 1887.

Tragacanth is useful to make adhesive emulsions, as with lime water, six grains to the ounce. The author finds emulsions of this kind valuable for applying such remedies as zinc oxide, sulphur, and resorcin, and they possess the advantages of being acceptable and of being easily removed with water.

SALVE-PENCILS.

As the name implies, these preparations are sticks, or crayons, composed of fatty substances with which the active ingredients are incorporated. They are insoluble in water. In consistence they are like the ordinary cosmetic stick, and are about as thick as the little finger. The base is composed of wax and olive oil, to which are added in some cases such substances as oil, soap, and pine or olibanum resin, to produce the proper consistence and coherence. The salve-pencils are useful for the treatment of isolated diseased areas where it is desirable to coat the epidermis and to bring a fatty remedy in close contact with the skin, as in psoriasis, seborrhœa, and dry eczema. The remedies used in this form comprise boric acid, carbolic acid, salicylic acid, chrysarobin, ichthyol, creosote, resorcin, soap-tar-ichthyol, corrosive sublimate, sulphur, oxide of zinc, and various other combinations.

PASTE-PENCILS.

The paste-pencils are devoid of fat, and are easily dissolved by the aid of moisture. They differ, therefore, from the salve-pencils in being applicable to surfaces deprived of epidermis, as in excoriations and ulcers, and in lesions of the mouth, anus, nose, and conjunctiva. They are useful in chancre, chancroid, and condyloma, also in acne and in lupus, and in other diseases where it is desirable to bore into the skin and to act upon or to destroy the diseased tissue. The medicament is thus brought into the closest contact with the affected skin. According to the drug used, their base consists of starch, sugar, tragacanth, and gum arabic, which with the active ingredient is moulded into short, brittle, cylindrical sticks, of about the thickness of a slate-pencil, which may be sharpened to a point. The principal drugs thus employed are salicylic acid (in several strengths), arsenous acid, corrosive sublimate, cocaine, iodoform, pyrogallol, and resorcin. They constitute a cleanly, convenient, and ready mode of treating discrete lesions or small patches, and may be applied by the patient at long or short intervals.

Unna[1] has conveniently grouped the various diseases and the remedies in which these salve-pencils (*stili unguentes*) and paste-pencils (*stili dilubiles*) may be employed with advantage. For the allaying of pain and itching where the skin is dry (as in pruritus and squamous eczema), the salve-pencils of belladonna, cocaine, and creosote, and, where the skin is moist (as in eczema madidans, excoriations, fissures, and superficial wounds), the paste-pencils of cocaine, may be employed. For the inflammatory diseases, pencils of zinc oxide, ichthyol, resorcin, and sulphur are serviceable; while for the mycotic and bacterial diseases, such as tinea tonsurans and furuncle, chrysarobin, pyrogallol, and corrosive sublimate are useful. In the so-called parakeratoses (as lichen planus and psoriasis), salve-pencils of tar, salicylic-acid-creosote, resorcin, and chrysarobin may be employed; and in the hyperkeratoses (as callosity, corn, and comedo), salve-pencils of salicylic acid and sulphur. The pigment anomalies are particularly suitable for treatment with salve-pencils of corrosive sublimate, carbolic acid, salicylic acid, and salicylic-creosote. Small tumors (such as pointed or flat warts, epitheliomata, and nævi) may be treated with salve- or paste-pencils of arsenic-sublimate, salicylic-creosote, pyrogallol, or resorcin.

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[1] Monatsh. f. prakt. Derm., 1886, p. 157.

Caustics.—Under this head may be classed those substances and preparations which are DISCUTIENT in their effect, as well as those which are truly CAUSTIC. To the former belong iodine, sapo viridis, corrosive sublimate, salicylic acid, resorcin, acetic acid, trichloracetic acid, lactic acid, cantharides, and the like. Some of these, as the trichloracetic and lactic acids, should be employed diluted. Among remedies of this kind nitrate of silver occupies a conspicuous place, being of service in fissures, in indolent excoriations and ulcers, and in various epithelial diseases where a stimulating or a mild caustic effect is desired.

CAUSTIC POTASSA, in stick form or in strong solution, is a potent escharotic. Employed full strength it is a powerful remedy, is exceedingly rapid in its destructive effects, and should always be used with great caution. It is applied diluted with good result in some new growths and hypertrophies, such as epithelioma, hypertrophic lupus vulgaris, and hypertrophic wart, especially where rapid and thorough destruction is demanded. It may be employed in its pure state, or, better, weakened with water or by admixture with other substances, as lime in the preparation known as POTASSA CUM CALCE. Its employment calls for skill, and especially for experience, as it is apt to destroy more tissue than is desired. It forms with the destroyed skin a black eschar, which in the case of superficial growths becomes detached in a week or ten days, leaving an open granulating wound. With water, one part to three or six, it is a safer remedy, and, if sufficient time be allowed, is equally effective. Caustic potassa, in the form of liquor potassæ, is a discutient or mild caustic, and may often be employed with advantage for the purpose of acting rapidly on infiltrated patches of inflammation and in other conditions.

Potassa in weak solution also serves as an antipruritic, being especially serviceable when combined with tar or carbolic acid, as in the following formula, introduced by L. D. Bulkley, both useful in many diseases accompanied with itching: Pix liquida, ʒi; potassa, ʒi; water, ℥i. It should be used freely diluted with water, and in most cases applied weak, —five or ten drops to the ounce. Carbolic acid may be used in the above formula instead of tar. Chloride of zinc is likewise a strong caustic, producing its effect slowly, but occasioning great pain both at the time of the application and for some time after the operation.

Arsenic may be employed alone or with powdered gum acacia, equal parts or one to four, with other substances, as the mercurials, in the form of escharotic powders and plasters, and prescribed especially in lupus vulgaris and in epithelial cancer. As a caustic it is somewhat slow, but is destructive in its action, and possesses the peculiarity of tending to attack diseased tissue in preference to healthy structures.

Nitric acid and the acid nitrate of mercury are well adapted for the treatment of chancroid and chancre, and some cases of nævi, moles, and warts. They should always be applied with care. Pyrogallol, resorcin, ethylate of sodium, and acetate of sodium may also be referred to. Acetate of zinc, nitrate of zinc, carbolic acid, and corrosive chloride of mercury are milder, and are occasionally used for purposes of superficial cauterization.

Acetic acid, trichloracetic acid, lactic acid, chromic acid, and salicylic acid are mild caustics, useful in epithelial hypertrophies, as wart, epithelial molluscum, and like affections.

Parasiticides.—These are remedies which act destructively upon both vegetable and animal parasites. Sulphur and its compounds, including sulphite of sodium, hyposulphite of sodium, and sulphide of potassium, in their action safe parasiticides, are deserving of the first mention, being effectual in both groups of diseases. Styrax and Peruvian balsam are especially valuable in destroying the itch-mite, while staphisagria, cocculus Indicus, white precipitate, mercurial ointment, corrosive sublimate, and petroleum are the best remedies against the pediculus. The vegetable parasites are acted upon favorably by a number of other substances, among which may be mentioned the mercurials, particularly corrosive sublimate, red iodide, the red and white precipitates, the yellow sulphate, and the red sulphide. Other drugs serve the same end, as, for example, goa powder, chrysarobin, veratria, tar, creosote, iodine, carbolic acid, salicylic acid, resorcin, and boric acid. The most valuable of the remedies mentioned are goa powder and its derivative chrysarobin. The latter is a powerful and effective remedy, introduced into England from the East some years ago by Balmanno Squire.

Antiseptics.—Among the various drugs used for the purpose of securing antisepsis in the treatment of wounds and for dressings, carbolic acid, corrosive sublimate, boric acid, salicylic acid, iodoform, and creolin are the most serviceable. The first two are in common use, and, if properly employed, are attended with comparatively little risk from absorption and poisoning. Aqueous solutions of CARBOLIC ACID are generally employed in two strengths, 5 per cent. (1 in 20) and 2½ per cent. (1 in 40), the former for the purpose of cleansing infected open lesions and wounds, the latter to wash out wounds during an operation and after it, and to wash the operator's hands, sponges, and instruments. Care should be observed that the solutions be properly prepared, lest there be globules of undissolved acid floating in the solution. Water alone takes up all the acid up to about 5 per cent. strength, beyond which it is less readily dissolved. The addition of a little glycerin facilitates the solubility. The purer the acid the less soluble it is in water.

CORROSIVE SUBLIMATE in aqueous solution is used for irrigating wounds and for disinfecting the hands in the strength of 1 : 1000 or 1 : 5000, according to the extent of the surface and other circumstances. Upon sound, unbroken epidermis it may be used 1 : 500 with safety, and the same strength may be employed for touching or wiping out infected wounds. Like carbolic acid, it is both irritating and poisonous: care should, therefore, be observed in its employment.

Phenacetin and acetanilid finely powdered are both useful as applications in syphilitic and other ulcers, possessing the power of diminishing suppuration. Among the bactericides and parasiticides serviceable in venereal ulcers, herpes, and burns, and in the diseases due to mould fungi, euphorin, europhen, and alumnol may be referred to.

Mechanical Methods.—The treatment of cutaneous diseases by mechanical means embraces agents of importance. Many procedures are made use of, some of them simple, others requiring the employment of instruments. FRICTION, with smooth and rough substances (as prepared PUMICE-STONE, SAND, SAND-SOAP, and the like), COMPRESSION, and MASSAGE are all used in one form or another, the two first-named especially, as with ointments, soaps, plasters, compresses, and bandages. The knife and lance are used for performing linear, quadrilateral, and punctate SCARIFICATIONS, as in lupus, in which they are especially valuable. Punctate and linear GALVANO-CAUTERIZATIONS are sometimes employed, but the simple linear and punctate scarifications with the knife leave a more sightly and superficial scar, with less tendency to hypertrophic scar or keloidal growths than the galvano-cauterizations. Excision with the knife, except for such new formations as cancer and various circumscribed growths or tumors, is seldom practised.

For the destruction of hair-follicles, in order to prevent the growth of hairs, the needle and the electric current (producing electrolysis) are of the greatest value, although the operation is generally followed by more or less scarring, the amount depending on the care and skill of the operator. The same process is also of much service for the removal of vascular nævi, telangiectases, and pigmentary and fibrous moles.

DERMAL CURETTE.

Scraping out localized areas of tissue, by means of the SCRAPING-SPOON, or DERMAL CURETTE, so useful in lupus, epithelioma, and other diseases characterized by new formations, is a method of decided value, and is much used for both small and large diseased areas, especially with the view of destroying exuberant unhealthy granulation tissue, thus permitting remedies to be applied to the true skin. In many cases, however, the operation itself suffices without subsequent applications other than simple dressings. While this instrument (made of different sizes and forms) finds its use chiefly in the removal of localized new growths, such as cancer, the scrofulodermata, and lupus vulgaris, it may also often be employed with advantage in certain inflammatory lesions, as in acne with comedo, and in various forms of hypertrophy, as, for example, in the warty formations and exuberant granulation tissue met with in many diseases. Its use has a wide application.

In addition to these agents there are certain special surgical instruments which may be mentioned, such as the ACNE LANCE; the MILIUM KNIFE OR NEEDLE; the COMEDO EXTRACTOR of Unna, of Hamburg, and of Piffard, of New York; the CUTANEOUS PUNCH, OR TREPHINE, for the removal of small growths, devised by Keyes, of New York, and Mixter, of Boston; EPILATING FORCEPS; GRAPPLING FORCEPS; SKIN-GRAFTING SCISSORS; CUTISECTOR, devised by Piffard; the apparatus for producing SPRAY; and the NEEDLE-HOLDER for the ELECTRIC CURRENT.

CUTANEOUS TREPHINE.

The CUTANEOUS TREPHINE, as described by Keyes,[1] is made of several sizes and has a sharp cutting edge. By pressing it upon the skin and rapidly rotating, a circular piece of skin, corresponding to the size of the instrument used, is cut; this projects, and is snipped off with scissors. The depth of the cut may be varied according to the degree of pressure used. The wound may be dressed with powdered sulphate of iron, boric acid, an adhesive plaster, or a cotton and collodion dressing. The amount of scarring depends upon the size of the instrument and other circumstances, but with the smallest-sized trephines it is usually scarcely perceptible. The instrument is useful for the removal of small epitheliomata, moles, granules of powder, and other blemishes, and in removing skin for microscopical examination and diagnosis.

Epilation.—The extraction of hair from the hair-follicles, particularly when systematically and methodically practised, is of value in some diseases of the hair and hair-follicles, such as sycosis, tinea sycosis, tinea tonsurans, tinea favosa, pustular eczema of the hair-follicles, and some forms of alopecia. Its value in sycosis was pointed out many years ago by Wertheim, of Vienna, and more recently by Zeissler,[1] of Chicago. By the extraction of the hairs a source of irritation to the follicles is removed, the follicles are rendered patulous, and the walls and the hair-papillæ are stimulated. In parasitic diseases not only is the hair-shaft in which the fungus is embedded removed, but through the keeping open of the follicles the parasiticides employed are brought into close contact with the tissues containing fungus. The forceps should have narrow blades, and a spring that works easily. In sycosis, if the operation causes pain, only one hair should be grasped at a time.

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[1] Jour. Cut. and Gen.-Urin. Dis., March, 1887.

Skin Grafting.—As Erichsen states, Hunter showed that the spurs of a young cock could be "made to grow on his comb," and that a tooth could be successfully transplanted. Reverdin, however, in 1869, was the first to call special attention to the subject of the GRAFTING OF EPIDERMIS, OR EPIDERMIC GRAFTING, in which operation small bits of epidermis, including the mucous layer, are transplanted from a healthy locality to an open granulating surface and there made to grow. Under favorable conditions this takes place readily, with the result that a layer of epithelium spreads out from the grafts, beginning at the margins, and unites with that from other neighboring grafts. A graft the size of a large pin-head or an oat will continue to grow until it reaches, by spreading out, the size of a small finger-nail. The growing of epithelium upon an open surface and thus covering the wound, however, does not constitute cicatrization of the fibrous tissue of the corium and the prevention of scar tissue. In such cases as wounds from burns epidermis grafting does not prevent the formation of a scar, though it probably lessens the tendency to it.

REVERDIN'S METHOD.

The grafts are to be obtained, where possible, from the individual who is to receive them. A healthy granulating surface is required. Every aseptic precaution in the removal of the grafts and in their implantation is to be employed, but antiseptic applications, such as corrosive sublimate and carbolic acid, are not to be used. A large piece may be divided and subdivided, a number of grafts being thus obtained, but the smaller the grafts the less painful will be their removal. The skin may be pinched up with a delicate forceps or with a fine sewing-needle inserted under the epidermis, and the graft snipped off with curved scissors or knife, removing just enough tissue (including the upper stratum of the papillary layer) to draw blood. The grafts are picked up on the point of a needle and thus placed in position. It has been shown that live grafts may be taken from an amputated limb as long as twenty-four hours after operation, provided the limb has been kept at a low temperature, just above the freezing-point. The skin of the prepuce, being devoid of fat, makes desirable material for the purpose. The mode of applying the grafts is much the same as in the Thiersch method, to be referred to. This method is especially applicable to leg ulcers.

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[1] Jour. Cut. and Gen.-Urin. Dis., 1891, p. 444.

THIERSCH'S METHOD.

Reverdin's method has been largely superseded by that introduced by Thiersch, of Leipsic, which is a decided improvement on the former. It consists in removing, by the razor or other instrument, thin slices or strips composed of true skin and epidermis and transplanting them to an open granulating surface or wound that has been prepared for their reception. Adhesion takes place, under proper dressings, and the wound or sore is thus covered in by cutaneous tissue, with the result of less scarring and contraction than under epidermis grafting,—Reverdin's method. The parts to be grafted are treated aseptically for several days with a solution of boric acid, and the granulations are cut down with a sharp knife, the bleeding being allayed by compression and torsion. Antiseptics are not called for. The strips of skin, which may be from one to four inches long and from one-half to three-quarters of an inch wide, taken from the thigh or arm, or from one of the lower animals, as a young greyhound, are bathed in a six-tenths solution of common salt, and at once placed on the wound, with the raw surface downward, so that one strip overlaps the skin and that the edges are covered in. The strips should be about one-half the thickness of the true skin, or as thin and at the same time as large as it is possible to cut them. Hemorrhage from the wound should be allayed before they are applied. The dressing to be placed next to the skin should be composed of a substance which will not adhere to the surface, as sterilized tin- or gold-foil, oiled silk or rubber tissue in sterilized oil, as proposed by Tillmanns, of Leipsic, or perforated paraffined paper, over which aseptic cotton compresses and a muslin bandage, exerting slight pressure, are laid. The first dressing should not be removed until the end of from two to four days. Within a few days after the grafting the corneous layer of the epidermis becomes detached from the mucous layer and floats away, leaving the mucous layer raw; but cornification usually soon sets in. Hemorrhage and suppuration are both liable to interfere with the success of the operation. The latter may be removed by absorption through perforations in the dressing applied next to the skin. This mode of treatment has a wide application in general surgery and in dermatology, especially in the case of wounds with loss of skin and epidermis, burns, and scalds, and in many diseases in which there is obstinate ulceration without disposition to heal, such as carcinoma and lupus, and in other neoplasms.[1]

Morrow[2] describes a modification of Thiersch's method, the peculiarity consisting in the depth of the graft, which includes the entire thickness of the skin and in some cases a layer of subcutaneous tissue, and in the method of procedure, which consists in removing a button of tissue of any required depth by means of a round, cutting, cutaneous punch, and immediately inserting it in a receptacle or bed previously made by the same instrument. It may be employed in the treatment of small circumscribed malignant and papillary growths occurring on the face, such as epitheliomata, lupus nodules, moles, warts, and other facial blemishes. Areas of integument containing hairs may be successfully transplanted by this method. The punches, or trephines, are manufactured of different sizes. The pain may be mitigated or prevented by cocaine used through cataphoresis, especially if the skin be punctured here and there to facilitate the entrance of the cocaine.

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[1] For more complete information on this method the reader is referred to an article by Urban, of Leipsic, in Deutsche Zeitschrift für Chirurgie, Bd. xliv., No. 187.

[2] Trans. Amer. Derm. Assoc., 1891. See also New York Med. Jour., Dec. 12, 1891.

Bandages.—Appliances of this kind are frequently made use of with great advantage for the purpose of protection or of affording support to the skin and subcutaneous tissues. Both acute and chronic conditions of œdema and stasis may be materially relieved by proper bandaging, especially in cases where the tissues are weakened through debility or age. In eczema, especially of the lower extremities, in elephantiasis, and particularly in ulcers, simple or specific in nature, the plain muslin or the rubber bandage is often employed with great benefit.

Poultices.—Preparations of this kind have but a limited use in dermatology. They are occasionally employed for removing thick, adherent masses of crust, as in severe and long-standing eczema, and also to relieve pain and to hasten suppuration in furuncle, carbuncle, and like inflammations. They are usually prepared with flaxseed meal, potato starch, or bread and milk, care being taken to make them antiseptic by the addition of suitable drugs, are applied warm or hot, and are repeatedly renewed.

PARAFFINED and WAXED PAPER serve many useful purposes as a dressing, taking the place in some cases of cloths for the spreading of ointments, pastes, and plasters. They protect the skin from the clothing, and exclude the air. They are employed especially upon parts where there is but little motion. Where fats or oils of any kind are spread upon the paper, they should be applied sparingly, in order to secure adhesion to the skin. Where fatty substances are used on cloths, the paper may be used to protect the clothing from becoming greased.

Massage.—In connection with the subject of mechanical treatment, the benefit to be derived from massage, in suitable cases, may be referred to. Certain forms of atrophy and hypertrophy of the integument, as morphœa, scleroderma, elephantiasis, and allied forms of disease; patches of chronic sclerosed inflammatory skin, as eczema, psoriasis, and lichen planus; prurigo; and affections of the sebaceous glands with a tendency to the accumulation of the secretion, may be specially mentioned.

Electricity.—This therapeutic agent may at times be applied with good result in certain affections, especially in those in which there is disturbance of the nervous system, as in herpes zoster and in the neuroses, and also in certain atrophies depending on changes in the nerves, as morphœa and scleroderma. The galvanic current is that from which the best effects are usually obtained, but the faradic current is also serviceable. Static electricity is sometimes made use of, especially in morphœa and scleroderma. The application may be either central or directly to the disease of the skin.

ELECTROLYSIS.

Electrolysis, or the decomposition of tissues by means of the galvanic current, is distinctly valuable in the treatment of certain tumors, especially vascular formations, tubercles, nævi, warts, moles, hypertrophies, small fibromata, and connective-tissue growths, as keloid. It is accomplished by means of needles (of steel or irido-platinum) in the place of ordinary electrodes, inserted into the tissues, superficially or deep, through which the current is discharged. The galvanic current is useful in eradicating abnormal growth of hair from circumscribed areas, and superfluous hairs from the face in women, and from moles.

The GALVANO-CAUTERY, especially as used with various pointed and cutting instruments, as devised by Besnier and Vidal, is of value in such diseases as lupus, nævus, and other new growths, and in some hypertrophies. PAQUELIN'S CAUTERY and its modifications (as the "micro-burner" of Unna) is made use of to destroy varied pathological formations, especially such new growths as angiomata, but, on account of the difficulty of regulating the depth to which cauterization may extend, it must be employed with caution.

CATAPHORESIS.

ELECTRIC CATAPHORESIS, or the introduction of drugs into the system through the action of electricity, especially the galvanic current, is occasionally made use of, but only small doses can be administered in this way through the skin. The process is a physical one. It is not electrolytic, no decomposition of the tissues taking place. Various drugs in solution, such as morphine, cocaine, the salts of mercury, and the iodides, may be employed, in some cases advantageously. A moderately strong current is required. The stronger the current the more rapid the effect. From ten to thirty cells of a Leclanché, Grenet, or chloride of silver battery, or from five to twenty milliampères, are required. The solution of the drug is used on the positive pole (or anode), the negative pole (or cathode) being placed anywhere. The skin should first be cleansed, and ether used with the view of dissolving the natural oils and fats on the surface and in the apertures of the follicles. For cocaine a ten per cent. solution is most useful, about fifteen milliampères being required. This may be employed to advantage in sensitive skins before operating with the needle and battery for the removal of hair from the face, and also for minor operations upon the skin. Pain may thus be avoided without the danger of producing constitutional effects. The iodides and the salts of mercury in solution may be used for the purpose of acting upon superficially seated diseases. Painful affections of the integument, as ulcers and superficial neuralgias, may be relieved by analgesics applied in this way. The use of some drugs, however, is painful: thus, a one per cent. corrosive sublimate solution causes a burning pain.

GENERAL PROGNOSIS.

This subject scarcely permits of being discussed on general grounds. There is little to be said concerning the prognosis of cutaneous diseases as a class. In nature the majority are benign; some are destructive and semi-malignant; others, either early or more frequently late during their course, tend to a fatal termination, this occurring in various ways. The annoyance, discomfort, disfigurement, or deformity accompanying certain cutaneous diseases is often great. The subjective symptoms, especially itching, burning, and pain, frequently cause much distress of body and mind. In many cases the subjects are truly pitiable, and worthy of the utmost consideration and attention. In prognoses the question concerns individual diseases and cases rather than classes. The diseases of the skin are acute, subacute, or chronic in their course; some are invariably acute, as herpes, while others are almost always chronic, as, for example, psoriasis. It may be said that the majority of the disorders and diseases, taking a view of the whole field, incline to chronicity. Many of them, as lupus erythematosus and lupus vulgaris, are exceedingly obstinate, lasting years; others, especially those of a congenital nature, as vascular nævus and ichthyosis, in almost all instances continue throughout life.

The employment of remedies, whether external or internal, it need not be said, materially influences prognosis. The natural course of the diseases, rather than the influence of these factors, will be dwelt upon in the present discussion. It may be stated that with the advances in therapeutics that are being made from time to time some diseases that formerly were regarded as hopeless are now curable. The value of an opinion in prognosis naturally depends upon the knowledge that is brought to bear on the subject, and especially upon the experience of the dermatologist.

Diseases of secretion, as seborrhœa and hyperidrosis, are often rebellious to treatment. The active hyperæmias, as long as they remain such, are usually ephemeral or acute disorders; but it must be remembered that if the action of the cause is prolonged or is carried beyond a certain point the process may become inflammatory, and the prognosis, consequently, more uncertain.

Of the inflammatory diseases as a class it is not possible to speak in general terms; for, while some always terminate favorably and within a definite period, others may end fatally, as, for example, chronic pemphigus. A considerable number of the inflammatory affections tend to become chronic, lasting not infrequently many years; as common instances, eczema, psoriasis, acne, and sycosis may be cited.

Hemorrhages are to be looked upon either in a favorable or in an unfavorable light, according to their severity and their extent. Hypertrophies, as a rule, have a benign character, but they tend to pursue a slow course, and often continue a lifetime. Some of them are incurable. The same observations apply to atrophies.

Neoplasmata, or new growths, inflammatory or otherwise, are benign, semi-malignant, or malignant. The prognosis of this large group of diseases will depend upon the disease and the case under consideration. Thus, lupus, syphilis, lepra, carcinoma, and sarcoma, taken as representatives of the new growths, must all receive grave prognoses. Several of them frequently terminate fatally. On the other hand, certain affections of this class, as fibrous molluscum, as a rule, give rise merely to discomfort and disfigurement.

The neuroses, some of which are fugitive, others persistent, are exceedingly variable in their course and duration; at times they yield readily to treatment, while in other cases they are very obstinate. The common vegetable and animal parasitic affections, characterized for the most part by inflammatory symptoms, are all amenable to treatment, and may generally be cured in a reasonable time.

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